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Coville, Frederick Vernon

The willows of Alaska

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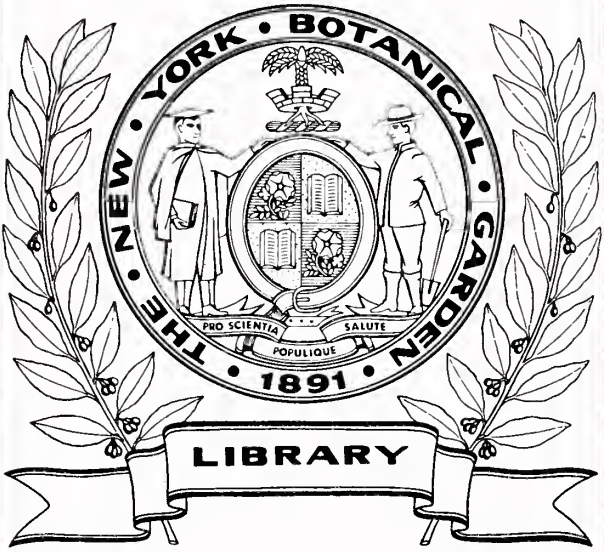
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PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

XXIV.

THE WILLOWS OF ALASKA.

BY
FREDERICK V. COVILLE.

WASHINGTON, D. C.
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PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

XXIV.

THE WILLOWS OF ALASKA.

[PLATES XXXIII–XLII. TEXT FIGURES 17–28.]

BY FREDERICK V. COVILLE.

THE Harriman Alaska Expedition of 1899 furnished an opportunity to observe and collect specimens of most of the willows of the Alaskan coast south of Bering Strait. The species were distinguished in the field without much difficulty, but the labor required to find the correct names of the species was greater, since it involved a careful review of all the literature on the subject and an equally careful examination of all accessible Alaskan collections. It has not been possible to examine the willows collected in that territory by the expeditions of various European nations, and in view of that fact I desire to express here the same hope as did Trautvetter in his admirable treatise *De Salicibus Frigidis* published in 1832:

> Errare quidem humanum est, sed discrimen statuimus inter errores, qui excusari possunt et qui non possunt. . . . Solatio mihi est spes, vos, benevolos lectores, errores meos in iis numeraturos esse, qui excusari possint.

Twenty-three species of willows are enumerated in the present paper. Two of these, *Salix arbusculoides* and *Salix myrtillifolia*, were collected only on the Canadian side of the Alaskan

boundary but so near it as to warrant the assumption that they occur on the other side also. Several species reported from Alaska, in local lists, have been omitted, chiefly because the obvious errors of some identifications throw doubt on all. It is probable, however, that Alaska contains species additional to those herein admitted. These are to be expected along the whole eastern boundary of the territory, where least systematic collecting has been done and where the chance of intrusion of species from the interior continental flora is greatest.

Of the twenty-three Alaskan willows, five are trees, 10 to 30 feet high, seven are erect bushes, commonly 2 to 8 feet high, and eleven are prostrate. The species in these groups are as follows:

TREE SPECIES.

S. alaxensis
S. amplifolia
S. bebbiana
S. nuttallii
S. sitchensis.

BUSH SPECIES.

S. arbusculoides
S. barclayi
S. commutata
S. glauca
S. niphoclada
S. pulchra
S. richardsoni.

PROSTRATE SPECIES.

S. arctica
S. chamissonis
S. fuscescens
S. glacialis
S. leiocarpa
S. myrtillifolia
S. ovalifolia
S. phlebophylla
S. polaris
S. reticulata
S. stolonifera.

Salix myrtillifolia is a rare species of whose habit there is no precise collector's record. Our specimens indicate that it is normally a prostrate plant but that when growing in sphagnum moss it tends to assume a somewhat upright form, a character observed in *Salix fuscescens* when growing in sphagnum bogs to the south of its more typical range on the northern tundra. Those bushy willows which range upward to timber line or northward to the tundra, as for example *Salix pulchra*, often

become prostrate from the severe climatic conditions to which they are exposed, particularly by their long enforced prostration beneath the snow and the repeated killing of upward shoots by cold winds. When these adverse conditions are removed such species assume their normal form. When a tree species flowers young, as is often true of *Salix sitchensis*, it may easily be mistaken for a bush willow; but an observation of the average height of mature plants will prevent error from such a source. Under very adverse surroundings even a tree willow may become prostrate, a condition observed in *Salix alaxensis* on the gravels at the terminal moraine of Muir Glacier.

Only one of the willows enumerated, *amplifolia*, is confined to Alaska, and on the other hand only two, *reticulata* and *glauca*, are strictly circumpolar. Between these two extremes of very restricted and very wide range, the species show three definite geographic relationships, with Siberia, with the Pacific Northwest Coast, and with the Interior of British America. Excluding the strictly circumpolar species, the willows common to Siberia and Alaska are

S. alaxensis
S. arctica
S. chamissonis
S. fuscescens
S. leiocarpa
S. ovalifolia
S. phlebophylla
S. polaris
S. pulchra.

One of these Siberia-Alaska species, *alaxensis*, is a tree, another, *pulchra*, a bush, and the remainder are prostrate. All the prostrate species belong to the true arctic or arctic alpine flora. Some of them overlap into the Hudsonian flora, while *pulchra* and *alaxensis* are Hudsonian species which abut against and even intrude into the arctic flora. The Alaskan willows of Siberian relationship may be considered, therefore, prevailingly arctic.

The species showing a relationship to the flora of the interior of the North American continent are:

S. arbusculoides
S. bebbiana
S. myrtillifolia
S. niphoclada
S. nuttallii
S. richardsoni.

Four of these species, *arbusculoides*, *myrtillifolia*, *niphoclada*, and *richardsoni*, are believed to belong to the Hudsonian flora, and two, *bebbiana* and *nuttallii*, to the next southerly flora, the one known technically as the Canadian. Thus, while there is considerable diversity in the zonal relationship of the species of this group, they may be considered prevailingly Hudsonian, or one stage more southerly than the Siberian species.

The remaining species, four in number, belong to the Pacific coast flora. They are:

S. barclayi — *S. sitchensis*
S. commutata — *S. stolonifera*.

Stolonifera is a local alpine species occupying a restricted area in the coast range of mountains from the vicinity of Juneau to Yakutat Bay, and the others are characteristic species of the so-called Sitkan flora, a modified Canadian flora with some Hudsonian elements, all adapted to the conditions of great humidity that prevail along a narrow strip of the Pacific coast from Oregon to southern Alaska. The average zonal position of these species is about the same as that of the preceding group.

To facilitate the identification of specimens, two keys have been prepared, a shorter one intended for use with typical specimens, and a longer one intended to bring out more precisely the characters of the various species and to cover the normal variations. The specimens cited cover primarily the collections of the Harriman expedition. Secondarily they cover the collections of Alaskan willows in the National Herbarium, and in the herbaria of the Missouri Botanical Garden, the New York Botanical Garden, and Columbia University. The last three collections, through the courtesy of the directors of these institutions, were loaned for use in preparing this paper.

As a further aid in recognizing species, each is illustrated by drawings made by Mr. F. A. Walpole. The drawings for the plates were made in the field from living plants; those for the text figures were made from herbarium specimens.

KEY TO ALASKA WILLOWS, BASED ON TYPICAL COMPLETE SPECIMENS.

Ovaries smooth.

Catkins sessile on old wood.....*S. richardsoni*, p. 315.

Catkins terminal on leaf-bearing, though sometimes very short and small-leaved, branches.
Plant an erect bush or tree.
Plant a tree, the leaves without stipules..*S. amplifolia*, p. 314.
Plant a bush, the leaves with toothed stipules.
Leaves glaucous beneath, the catkin scales black.
S. barclayi, p. 316.
Leaves green beneath, the catkin scales yellowish.
S. commutata, p. 317.
Plant prostrate.
Leaves crenate about the whole margin.
S. myrtillifolia, p. 325.
Leaves entire or sparingly toothed toward the base.
Leaves bright green and shining on both surfaces.
S. leiocarpa, p. 338.
Leaves glaucous beneath.
Style about 1.5 mm. long.....*S. stolonifera*, p. 333.
Style about .5 mm. or less in length.
Pedicels about three times as long as the nectaries, style almost wanting.....*S. fuscescens*, p. 329.
Pedicels not longer than the nectaries, style about .5 mm. long.....*S. ovalifolia*, p. 331.
Ovaries hairy.
Catkin scales several times longer than their hairs, filaments hairy below.....*S. reticulata*, p. 340.
Catkin scales little or not at all longer than their hairs, filaments smooth throughout.
Catkin scales yellowish throughout.
Pedicels several times the length of the nectaries, in fruit exceeding the catkin scales.....*S. bebbiana*, p. 306.
Pedicels at most three times the length of the nectaries, never exceeding the scale.
Leaves acute at the base, on petioles several millimeters in length.....*S. glauca*, p. 321.
Leaves rounded at the base, on petioles 2 mm. or less in length.....*S. niphoclada*, p. 322.
Catkin scales black, at least at the apex.
Leaves finely and evenly serrate or crenate about the whole margin.
Plant erect, the leaves oblanceolate, sericeous beneath.
S. arbusculoides, p. 323.

Plant prostrate, the leaves obovate, smooth beneath.
S. chamissonis, p. 325.
Leaves entire or remotely denticulate.
Plant prostrate.
Leaves bright green on both sides.
S. phlebophylla, p. 336.
Leaves pale or glaucous beneath.
Twigs barely 1 mm. in diameter, rooting in the second year.....*S. polaris*, p. 335.
Twigs thicker, seldom rooting.
Catkin ovoid-globose, style almost none.
S. glacialis, p. 329.
Catkin cylindrical, style well developed.
S. arctica, p. 326.
Plant an erect bush or tree.
Leaf smooth on both surfaces.....*S. pulchra*, p. 319.
Leaf with some permanent pubescence beneath.
Leaf with a white tomentum of curled hairs beneath.
S. alaxensis, p. 311.
Leaf with dense or scanty short appressed hairs beneath.
Catkins appearing before the leaves, the permanent pubescence of the latter beneath very scanty, stamens 2 in each flower.....*S. nuttallii*, p. 310.
Catkins appearing with the leaves, the permanent pubescence of the latter beneath dense and satiny, stamens 1 in each flower.....*S. sitchensis*, p. 307.

Key to Alaska Willows, Based on Pistillate Leaf-bearing Specimens.

Leaves obovate, usually wedge-shaped at the base, glabrous, usually glaucous beneath, minutely and closely glandular-serrate, not crenate, about the whole margin; plant prostrate.
S. chamissonis, p. 325.
Leaves not with all the characters given above, particularly with reference to the serration; plant often erect.
Leaves not exceeding 2 cm. in length, without stipules, bright green and shining on both surfaces, not glaucous beneath, entire, glabrous, except for the few long hairs usually present on the margin, a few of the principal veins standing out very conspicuously on the fresh leaves and often forming a skeleton after a few years from the weathering of the softer matter of the persistent dead leaves.

Leaves broadly obovate or orbicular, rounded or retuse at the apex, commonly 4 to 6 mm., and rarely exceeding 10 mm., in length; pistillate catkins globose to oblong, few- (usually 2- to 8-) flowered; ovary smooth.....*S. leiocarpa*, p. 338.

Leaves oblanceolate to obovate, acute to obtuse at the apex, tapering to the base, commonly 10 to 15 mm. long; pistillate catkins cylindrical, many-flowered; ovary usually hairy.

S. phlebophylla, p. 336.

Leaves not with all the characters given above.

Leaves orbicular to oval, glaucous and very prominently reticulated beneath, rugose above; catkins equaled or nearly equaled by their peduncles; scales of the catkins reddish purple, usually smooth on the outside, several times longer than the hairs of the margin and inner surface; capsules hairy; stigma sessile or nearly so..... *S. reticulata*, p. 340.

Leaves or other parts not as described above.

Plant prostrate, cespitose; branches very slender, a millimeter or less in diameter, becoming firmly rooted; leaves oval to orbicular or nearly so; catkins oblong to globose; ovaries hairy or sometimes nearly smooth, but not glaucous; style plainly developed but less than a millimeter in length.

S. polaris, p. 335.

Plant not with all the characters given above.

Leaves very smooth on both surfaces, except for a few long hairs (early deciduous) on the margins and midrib when young, bright green and shining above, glaucous beneath, rhombic-oblanceolate or sometimes rhombic-obovate, narrowly wedge-shaped at base and usually at the apex also; stipules narrowly linear-lanceolate, persistent, serrate; catkins sessile or nearly so on old wood, the scales black, oblanceolate; stalk of the hairy capsule about as long as the nectary; style about 1 to 1.5 mm. long. *S. pulchra*, p. 319.

Leaves or other parts not as described above.

Ovary and capsule smooth, at least over most of its surface.

Plant prostrate or nearly so, less than a foot in height.

Leaves finely and evenly crenate about the whole margin; catkins almost sessile, but the very short peduncle bearing a few small leaves.

S. myrtillifolia, p. 325.

Leaves entire, or sometimes with a few scattered teeth below, catkins borne on a well-defined leafy peduncle

or branch of the season half a centimeter to two or three centimeters long.

Leaves rhombic-obovate, narrowed toward the base, broadest above the middle; pedicel of the ovary about three times the length of the nectary; capsule shining, not glaucous; style almost none, barely .25 mm. in length.

S. fuscescens, p. 329.

Leaves oval to orbicular, sometimes obovate; pedicel of the ovary little or not at all exceeding the nectary; style evident.

Capsule glaucous; style about .5 mm. long.

S. ovalifolia, p. 331.

Capsule not glaucous; style about 1.5 mm. long.

S. stolonifera, p. 333.

Plant an erect bush or tree.

Plant a tree with oval leaves when fully developed 3 to 5 cm. wide, and devoid of stipules; catkins about 1.5 cm. in diameter in flower and often 2 cm. in fruit.....*S. amplifolia*, p. 314.

Plant a shrub, commonly 1 to 2 meters high; leaves usually smaller, commonly oblong-lanceolate (though sometimes as broad and large as the last), and with ovate to lanceolate, glandular-denticulate stipules.

Stems densely hirsute; stipules usually persistent for several years on the stout stems; catkins sessile on old wood, all leaves and green bracts appearing later and from separate buds.

S. richardsoni, p. 315.

Stems often smooth; stipules seldom persistent on old wood; catkins on short leafy-bracted peduncles appearing with the leaves.

Leaves crenate-serrate (the somewhat gland-tipped teeth incurved), glaucous beneath, though this character sometimes obscure in young leaves; catkin scales usually black.

S. barclayi, p. 316.

Leaves finely glandular-denticulate (the teeth not incurved) throughout or only toward the base, or entire, not glaucous beneath, of nearly the same

color on both surfaces; catkin scales usually yellowish or straw-colored.

S. commutata, p. 317.

Ovary densely hairy, the capsule by expansion more sparingly so.

Leaves provided beneath with a dense, white, opaque covering of curled and tangled hairs.

S. alaxensis, p. 311.

Leaves not as described.

Leaves rather narrowly elliptical-lanceolate, acute at both ends, minutely and rather closely crenate-denticulate about the whole margin, glaucous beneath, the lowermost usually smooth on both surfaces, the upper clothed beneath with fine appressed hairs; stalk of the ovary equalling or twice as long as the nectary; style less than 1 mm. long.

S. arbusculoides, p. 323.

Leaves or other parts not as described.

Catkins appearing before the leaves, the usually very short peduncle devoid of leaves, though sometimes with very rudimentary leaves or bracts; leaves with permanent appressed pubescence of short hairs beneath, dense when young, sparse when old, the upper surface with some similar pubescence above when young, oblong-lanceolate to obovate-lanceolate, usually acute at either end; catkin scales black; style short, 5 mm. or less in length.....*S. nuttallii*, p. 310.

Catkins appearing with or after the leaves, the fresh growth on which the catkin is borne always having either leaves or green leaf-like bracts; other organs not all as described above.

Leaves oblanceolate to obovate, tapering to the base, usually rounded at the apex, entire or remotely glandular-denticulate, permanently satiny beneath with a dense covering of very short, straight, appressed hairs.

S. sitchensis, p. 307.

Leaves not as described.

Stalk of the ovary few to several times the length of the nectary, very slender, in fruit

exceeding the scale and sometimes becoming twice or three times as long.
S. bebbiana, p. 306.
Stalk of the ovary not more than twice or sometimes three times the length of the nectary but always shorter than the scale.
Plant an erect shrub; leaves permanently clothed on the lower surface, and sometimes also the upper, with a usually sparse covering of long appressed hairs; scales of the catkin light brown to straw-colored.
Leaves wedge-shaped at the base, on petioles several millimeters in length.
S. glauca, p. 321.
Leaves rounded or cordate at the base, on very short petioles, those on our specimens 2 mm. or less in length.
S. niphoclada, p. 322.
Plant prostrate; leaves often with some long silky hairs when young but glabrous at maturity, or with hairs only on the margins or midrib; scales of the catkin almost always black.
Leaf-blade 1.2 cm. or less in length; catkin short, ovoid-globose; style reduced to a mere neck... ...*S. glacialis*, p. 329.
Leaf-blade usually much larger; catkin elongated, cylindrical; style well developed.....*S. arctica*, p. 326.

1. SALIX BEBBIANA Sargent. Bebb Willow.

Salix rostrata RICHARDSON in Franklin, Journ. Pol. Sea 753. 1823; not Thuill. 1799.
Salix bebbiana SARGENT, Gard. & For. 8: 463. 1895.

A small tree with leaves elliptical-lanceolate or ovate-lanceolate, either rounded or acute at the base, acute or acuminate at the apex, sparingly pubescent when young, becoming nearly smooth in age, usually crenate-denticulate, but sometimes entire, commonly 3 to 5 cm. long. The pale brown or straw-colored catkin scales, the pubescence of the slender ovaries, their very long slender pedicels, and the almost complete absence of a style are especially characteristic of the species. It is widely distributed, extending almost entirely across British

America. It occurs in most of the northern portions of the United States, reaching southward in the east to Pennsylvania, in the Rocky Mountain region to New Mexico and Arizona, and on the Northwest Coast to Oregon. The original specimens were collected on Sir John Franklin's first expedition, in the interior of British America. In Alaska the species has a very restricted range from the upper waters of Cook Inlet eastward to the upper Yukon Valley. Near Homer, in Cook Inlet, on the brushy portion of the point, it is reported by Mr. Evans as a shrub or small tree 4 to 15 feet (1.2 to 4.5 meters) high, at Kasilof[1] 10 to 25 feet (3 to 7.5 meters) high and 8 inches (20 cm.) in diameter.

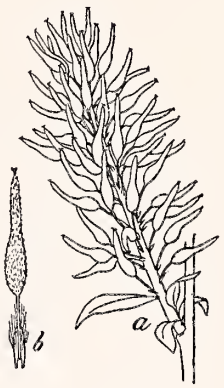

FIG. 17. *Salix bebbiana* Sargent: *a*, fruiting catkin, natural size; *b*, capsule, with pedicel, scale, and nectary, enlarged two diameters.

The following specimens have been examined:

Cook Inlet.—At Homer, Sunrise, and Kasilof, Walter H. Evans, 1897 (Nos. 470, 491), 1898 (No. 693). At Kenai, F. A. Walpole, 1900 (No. 1143). Between Cook Inlet and the Tanana River, probably from the lower Sushitna, E. F. Glenn, 1899.

Yukon Valley.—Near the junction of Forty-mile Creek and the Yukon, Frederick Funston, 1893 (Nos. 39, 42). At Fort Yukon, F. C. Schrader, 1899.

Dr. P. A. Rydberg has published recently,[2] while this paper was in press, a *Salix perrostrata*, based primarily on specimens collected by himself near Hermosa, in the Black Hills of South Dakota, and to that species he has referred a specimen collected by Mr. R. S. Williams at Dawson, Yukon Territory, besides assigning the species a range northwestward to Alaska. While his bibliographical references indicate that the species is a segregate from *bebbiana*, the author gives no comparison of distinguishing characters. I am unable to find in his description anything to distinguish our Alaskan specimens from what I take to be typical *bebbiana*, whatever may prove to be the relation of that species to the Black Hills willow.

2. SALIX SITCHENSIS Sanson. Satin Willow.

Plate XXXIII.

Salix sitchensis SANSON; BONGARD, Mem. Acad. Petersb. VI. Math. & Nat. 2: 162. 1831.

[1] Variously spelled Kassiloff, Kassilof, Kussilof, Kussilow, etc.

[2] Bull. N. Y. Bot. Gard. 2: 163. 1901.

Salix sitchensis is ordinarily a large shrub or small tree, individual specimens often reaching 10 to 15 or rarely 30 feet (3 to 9 meters) in height, with a trunk four to six inches or occasionally even a foot (10 to 30 cm.) in diameter. In exposed situations it sometimes flowers and fruits as a small shrub a few feet in height, and on the bare morainal gravels at Muir Glacier it even joined the other smaller willows in becoming almost prostrate. In addition to the attractiveness of a rather graceful form, this willow bears a foliage of singular beauty. On close inspection the leaves present a satiny sheen of daintiest delicacy and softness, varying in intensity with the unevenness of the leaf surface. This appearance, largely lost in the dried specimens, is due to a dense covering, on the lower surface of the leaves, of closely appressed short hairs. No other Pacific Coast willow has the same character, and when one has known it in the field he can, by its foliage alone, readily distinguish this satin willow from all the other species. The leaves are oblanceolate to obovate, broadly acute to obtuse at the apex, narrowed at the base, entire or sometimes remotely denticulate, and when fully developed about 4 to 6 cm. long, except on vigorous shoots, where they often reach 10 cm. The flowers of the male catkins have but a single stamen each. All other Alaskan willows have two stamens.

Salix sitchensis is a characteristic plant of the Sitkan floral district, extending from the southernmost limit of Alaska northward and westward along the coast to Cook Inlet and the eastern end of Kadiak Island. It was observed at as high an elevation as 1,400 feet. Where the forests of Sitka spruce were dense this willow grew along the streams and beaches and in similar sunshiny situations, but where the forest was open or wanting it might occur anywhere on the solid upland at the proper elevation. South of Alaska, *Salix sitchensis* extends along the coast to California, and along the mountains through British Columbia into the Cascade Range of Washington and Oregon.

The wood of the satin willow is sometimes used by the Indians of southern Alaska in drying salmon, since its smoke does not give the fish a bad taste as do some other kinds of fuel. Its pounded bark is sometimes applied directly to a cut or wound, to assist in healing. The Tlinkit tribes, which extend from Yakutat Bay nearly or quite to Dixon Entrance, call it *chahtl*, or more precisely, *ch'ä'-tlh*.[1] They give the same name to other and probably to all the species of willow in that region. This shows how little the willows enter into their useful arts, for wherever in the United States the willow is employed in

[1] The diacritic marks used are those of the Century Dictionary.

basket making or other arts, the widely differing qualities of the various species have caused the Indians to give them discriminating names. Among the natives of Kadiak the word for various other species of willow, *nimuyok* (*ni-mo̊-yäk'*), is doubtless applied to the satin willow also.

Specimens of *sitchensis* have been examined as follows:

Behm Canal.—At "Shehshooh[1] Lake," M. W. Gorman, 1895 (No. 38).

Wrangell.—On the hillside back of the town, Coville and Kearney (No. 426), Trelease and Saunders (Nos. 3352, 3363), Walter H. Evans, 1897 (No. 78).

Sitka.—Along Indian River, Coville and Kearney (No. 838), A. Kellogg, 1867 (175, in part), Walter H. Evans, 1897 (No. 228). It was here, undoubtedly, that Henry Mertens, the botanist of Lütke's Expedition, in an excursion from Sitka to the summit of the neighboring Mount Verstovia, in the year 1827, discovered this willow. And here the writer on June 16, 1899, on a similar excursion found it still growing. The dense forests of spruce about Sitka do not afford suitable conditions for the tree, and it was not observed at any other point in the vicinity. Exactly similar was the situation in Mertens' time. He says, "Here alone [at the crossing of a 'wild mountain current'] is seen the solitary species of Salix which the environs of Sitcha afford."[2]

Stephens Passage.—At Taku Harbor, Coville and Kearney (No. 481).

Juneau.—In and above Silver Bow Basin, Coville and Kearney (Nos. 566, 594, 2534), Walter H. Evans, 1897 (No. 155).

Skagway.—At Glacier on the White Pass railroad, F. A. Walpole, 1900 (No. 1264).

Glacier Bay.—Abundant at various points, Coville and Kearney (Nos. 624, 633, 634, 698a, 701), Trelease and Saunders (Nos. 3354, 3355, 3377, 3378), Brewer and Coe (Nos. 38, 39), Kincaid.

La Perouse Glacier.—Near the beach, west of the glacier, Fernow.

Yakutat Bay.—At many points, Coville and Kearney (Nos. 998 to 1000, 1082a, 1121, 1154), Trelease and Saunders (Nos. 3357, 3358, 3360, 3361, 3369).

Kadiak Island.—At English Bay, about 8 miles south of Kadiak[3] village, Coville and Kearney (No. 1440).

[1] Supposed to be the lake at the head of Yes Bay.

[2] See Hooker, Bot. Misc. 3: 18. 1833.

[3] This is Woman's Bay of some charts, having been named *babia* (*woman's*) by the Russians. W. H. Osgood and F. A. Walpole report that it is known at Kadiak by the name English Bay only.

3. SALIX NUTTALLII Sargent. Nuttall Willow.

Salix flavescens NUTT. Sylv. 1: 65. 1842, not Host, 1828.
Salix nuttallii SARGENT, Gard. & For. 8: 463. 1895.

A small tree 3 to 5 meters (about 10 to 16 feet) in height and commonly 7.5 to 10 cm. (3 to 4 inches) in diameter. The leaves are obovate to oblanceolate, tapering at the base, acute or sometimes obtuse at the apex, entire or occasionally somewhat crenate-denticulate, the lower surface with some scattered appressed hairs or, on vigorous shoots, a somewhat velvety pubescence, but without the satiny lustre of *sitchensis*. When in flower this willow is conspicuous for its leafless twigs and the prominence of the black, sparsely hairy catkin scales. The original specimens were collected by Nuttall "in the range of the Rocky Mountains" at some point near the present route of the Union Pacific railway from Nebraska to Oregon.

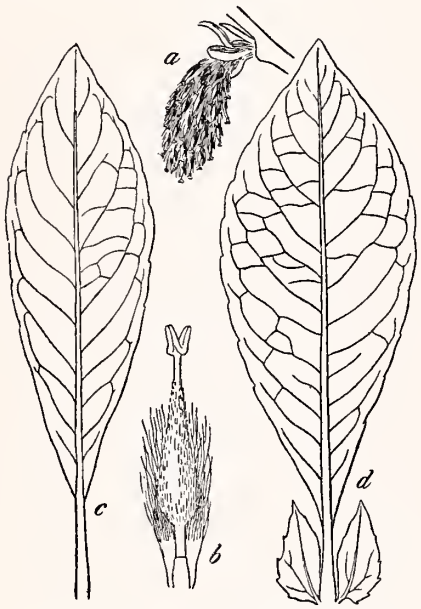

FIG. 18. *Salix nuttallii* Sargent: *a*, pistillate catkin, natural size; *b*, pistillate flower, enlarged six diameters; *c*, *d*, leaves, natural size.

Our Alaska material is as follows:

Skagway to Lake Bennett.—From Skagway to Glacier on the White Pass railway, Coville and Kearney (Nos. 493, 503), F. A. Walpole, 1900 (No. 1076). From Bennett to Log Cabin, F. A. Walpole, 1900 (Nos. 1083, 1271). At Lake Bennett, J. B. Tarleton, 1899 (No. 21).

Cook Inlet.—At Halibut Cove in Kachemak Bay, Coville and Kearney (No. 2416), the specimens in leaf only.

The name *Salix nuttallii* is ordinarily used to designate a species (or perhaps a group of species) finding its eastern limit in the Rocky Mountains and its western limit at the shore of the Pacific. It occurs as far south as Utah and Arizona, and in California extends southward along the coast to the bay of Monterey and along the Sierra Nevada to the San Bernardino range. Northward from California it is

abundant along the coast and in the mountains to British Columbia. The form that occurs along the Pacific Coast from California to British Columbia differs in several respects from the Rocky Mountain plant and has been designated, either as a species or a variety, by the names *brachystachys*, *capreoides*, and *scouleriana*. My attention has recently been called by Professor C. V. Piper to the fact that this last name, *scouleriana*,[1] is a valid name, and the oldest name, for the Pacific Coast plant, and is older than the name *nuttallii*. It appears that Andersson in making a critical identification of the type specimens of *scouleriana*,[2] found that the leaf specimen belonged to *sitchensis*, while the flowering specimen, which therefore represented the real *scouleriana*, he referred to *Salix flavescens* Nutt. Professor Sargent, finding *flavescens* to be a homonym and considering the Rocky mountain plant and the Pacific Coast plant to belong to the same species, followed a course which was inadmissible under the circumstances and gave the species a new name, *nuttallii*, instead of taking up *scouleriana*. Until a critical revision of these willows has been made it will probably be most convenient and least confusing to treat *scouleriana* and *nuttallii* as distinct species.

Salix nuttallii, like *Salix bebbiana*, evidently reaches Alaska by an extension of its range in the interior of British America, through the humid Sitkan flora, to the coast at Skagway and Cook Inlet. *Salix scouleriana* apparently does not extend as far north as Alaska. Its only claim to admission into that flora rests on some imperfect young specimens from Wrangell, without flowers or fruit, which may be referable to *sitchensis*. Kellogg's specimens of *scouleriana*, reported as collected at Kadiak and Sitka, in fact came from Vancouver, British Columbia.

4. SALIX ALAXENSIS (Anders.) Coville. Feltleaf Willow.

Plate xxxiv.

Salix speciosa Hook. & Arn. Bot. Beech. Voy. 130. 1832, not Host, 1828.
Salix speciosa alaxensis Anders. in DC. Prodr. 16²: 275. 1868.
Salix alaxensis Coville, Proc. Wash. Acad. Sci. 2: 280. 1900.
Salix longistylis Rydberg, Bull. N. Y. Bot. Gard. 2: 163. 1901.

This willow differs notably in its foliage from all the other Pacific Coast species, so much so, indeed, that Hooker and Arnott, the conservative authors of the 'Botany of Captain Beechey's Voyage in the Blossom,' described the plant from specimens devoid of flowers or fruit. The under surface of the leaves is covered with a dense white

[1] Barratt; Hook. Fl. Bor. Am. 2: 145. 1838–9.
[2] See Bebb, Gard. & For. 8: 373. 1895.

wool or felt made up of curled and tangled hairs, presenting an appearance quite different from the velvety, or satiny, or cobwebby pubescence of other species. The leaves are narrowly to broadly elliptical-lanceolate, acute at the apex and base, smooth or nearly so on the upper surface, of an apparently thick texture, due largely to the dense woolly covering of the lower surface, often corrugate-reticulate, the margins of the very young leaves often minutely glandular-denticulate, at maturity usually entire and sometimes revolute, the stipules usually present, narrowly linear-lanceolate to filiform, and entire. The fruiting catkins are very long and thick, some of those collected reaching a length of 14 cm. and a diameter of 1.8 cm. The stout twigs are either smooth or densely hairy, and sometimes they have a decidedly blue color from the presence of a conspicuous bloom.

Salix alaxensis extends from the northern part of Alexander Archipelago westward along the Alaskan coast to the peninsula, northward along the eastern side of Bering Sea through Bering Strait to Cape Lisburne, and through the interior of Alaska to the Mackenzie River in British America. East of Kadiak it is associated with other species of tree willows, but west of that point it is the only willow that presents the form and dimensions of a tree. From the Shumagin Islands eastward full-grown specimens are ordinarily about 20 to 30 feet (6 to 9 meters) in height, with a trunk four to six inches (10 to 15 cm.) in diameter. Under suitable conditions it doubtless reaches a still larger size. On the wind-swept Aleutian Islands, like all other arboreal vegetation, it appears to be wanting, but on the mainland to the north it again appears, on Buckland River, at the eastern end of Kotzebue Sound, reaching a height of 16 to 20 feet (according to Seemann in the 'Botany of the Herald'), farther north in the sound only eight feet, and at its northern limit, Cape Lisburne, being reduced to a shrub only two feet high. Like *Salix sitchensis*, it becomes almost prostrate on the naked gravels at Muir Glacier, while only a few miles away, on older glacial deposits which have been reclothed with an abundant vegetation of shrubs, it develops into a handsome small tree, a difference of habit illustrating the marked effect of different local conditions.

The original specimens of Hooker and Arnott's *speciosa* came from Kotzebue Sound, those of Andersson's *speciosa alaxensis* from "Alaxa Americae occidentali-borealis."

The feltleaf willow holds an important economic relation to the mining industry and to human existence generally in northern Alaska, for while spruce timber apparently does not extend north of the divide

separating the waters of the Yukon and the rivers flowing into Kotzebue Sound from those of the Arctic coast, this tree-willow does extend beyond that divide to the headwaters of the Arctic rivers, and in many places furnishes the only wood available as fuel to Indians, prospectors, and explorers.

Mr. Rydberg's *Salix longistylis*, based on a specimen collected at the mouth of Klondike Creek, Yukon Territory, although compared by him only with *Salix sitchensis*, is clearly identical with the present species.

Specimens of *Salix alaxensis* have been examined as follows:

Skagway and *White Pass.*—At Glacier on the White Pass railroad, and at Skagway, F. A. Walpole, 1900 (Nos. 1071, 1077, 1106).

Lake Bennett.—On the shore and uplands, J. B. Tarleton, 1899 (No. 12, in part).

Glacier Bay.—At various points about the bay, Coville and Kearney (Nos. 622, 639, 663, 696, 698, 699, 702), Trelease and Saunders (Nos. 3344 to 3348, 3364), Brewer and Coe (No. 57), Walter H. Evans, 1897 (No. 156).

Yakutat Bay.—Abundant on the west side of the bay, and at its northern end and arms, Coville and Kearney (Nos. 996, 1058, 1120, 1149), Trelease and Saunders (Nos. 3349, 3359, 3470, in part).

Prince William Sound.—At Port Wells, Coville and Kearney (No. 1270), Trelease and Saunders (No. 3372), Brewer and Coe (No. 136).

Cook Inlet.—At several points between the head of Cook Inlet and the Tanana River, E. F. Glenn, 1899. Sparingly on the delta of a glacier at Halibut Cove, Kachemak Bay, Coville and Kearney, No. 2419).

Kadiak Island.—Sparingly on the lower mountain slopes in English Bay, Coville and Kearney (No. 1441). Near Kadiak village, Trelease and Saunders (No. 3351), Brewer and Coe (No. 223).

Shumagin Islands.—Sparingly at Sand Point and in other localities on Popof and Unga, Coville and Kearney (No. 1622), Trelease and Saunders (No. 3343), M. W. Harrington, 1871–2. At Mist Harbor, Nagai Island, C. H. Townsend, 1893.

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (No. 1622), Trelease and Saunders (No. 3350); in Stepovak Bay, Palache; and at Nushagak, C. L. McKay, 1881.

Yukon Valley.—Headwaters of Koyukuk River, F. C. Schrader, 1899. At Rampart House, on the Porcupine River, Frederick Funston, 1894 (No. 175). At Dawson, Yukon Territory, R. S. Williams, 1899.

Kotzebue Sound.—At Camp Retreat, on the delta of the Kowak or Putnam River, G. M. Stoney, 1886.

5. SALIX AMPLIFOLIA Coville. Yakutat Willow.

Plate xxxv.

Salix amplifolia COVILLE, Proc. Wash. Acad. Sci. 2: 282. *pl. 15.* 1900.

A shrub or small tree, ordinarily about 10 to 16 feet (3 to 5 meters) high, with a trunk three to four inches (7.5 to 10 cm.) in diameter, but sometimes attaining a height of 25 feet (7.5 meters) with a trunk a foot (30 cm.) thick. The young twigs are stout and densely villous-pubescent. The leaves are large, oval to broadly obovate, 5 to 8 cm. long when fully developed, entire, or denticulate on the margins below, somewhat villous when young, smooth or nearly so at maturity, without stipules. The catkins, appearing with the leaves on leafy-bracted peduncles, are very large and thick, about 1.5 cm. in diameter and 4 to 6 cm. in length, the fruiting catkins often becoming 2 cm. in diameter. The ovary and capsule are smooth, the style commonly 3 to 4 mm. long. Occasionally the ovaries are slightly hairy. The species is known only from Yakutat Bay, Alaska, where it was discovered by the Harriman Expedition. The tree was first observed on the west shore of the bay growing on and near the sand dunes that lie back of the beach, and was afterward collected in Disenchantment Bay at Egg Island, Hubbard Glacier, and Haenke Island, and later at the Indian village at the head of Yakutat Bay, east shore. Specimens were collected by Coville and Kearney (Nos. 1013a, 1061, 1062, 1074, 1089, 1122, 1123, 1153, 1158), Trelease and Saunders (Nos. 3340 to 3342, 3465), Brewer and Coe (Nos. 89, 90), and Fernow. The type specimen, No. 1153, was collected at the Indian village, not as stated in the original description on the west shore of the bay.

Salix amplifolia bears considerable resemblance to *richardsoni* and *barclayi*, but the species from which it differs least is *Salix hookeriana* Barratt, which occurs on the sea coast from Oregon to British Columbia. Like *amplifolia*, *hookeriana* lacks the stipules so conspicuous in *richardsoni* and in *barclayi*, but *hookeriana* is readily distinguishable from the Yakutat tree by its shorter styles, about 1 mm. in length, the permanent though sometimes thin tomentum on the backs of the leaves, the earlier appearance of the catkins, which precede the leaves, and the absence or rudimentary character of the green bracts on their peduncles.

6. SALIX RICHARDSONI Hook. Richardson Willow.

Salix richardsoni Hook. Fl. Bor. Am. 2: 147. *t. 182.* 1838–9.

An erect bushy willow, from a meter or sometimes less to 2.5 meters in height, the branches stout and hairy, and retaining the dead stipules of the preceding year's growth. These stipules are lanceolate, glandular-serrate, and very large, commonly 1 to 2 cm. in length. The catkins, which appear before the leaves, are sessile on one-year-old wood, stout, and closely flowered, with densely long-hairy scales but smooth long-styled ovaries and capsules. The leaves are bright green, smooth on both sides (the scant cobwebby hairs present in the unfolding leaf-buds very early deciduous), paler and at maturity perhaps glaucous beneath, oblong-ovate to obovate-lanceolate, apparently 3 to 6 cm. long at maturity, sparingly glandular-denticulate, particularly toward the base, on short woolly petioles. This willow was originally collected by Richardson, naturalist of Sir John Franklin's expeditions, at Fort Franklin on the Mackenzie River in the interior of northern British America. We now have specimens from the vicinity of White Pass, Alaska, and from Port Clarence, indicating an extensive range in the interior of Alaska and the interior of northwestern British America.

Fig. 19. *Salix richardsoni* Hook.: *a*, pistillate catkin, showing at the base two persistent stipules of the preceding season's development, natural size; *b*, pistillate flower, enlarged six diameters; *c*, leaf, natural size.

Specimens have been examined as follows:

Mackenzie.—At Fort Franklin, on Mackenzie River, Richardson. One of the labels reads, "7 feet high, erect and spreading."

Yukon.—On the shore of Lake Bennett, J. B. Tarleton, 1899 (Nos. 12, in part, 14). Marked "5 to 8 feet high."

Port Clarence.—In a brushy area along a stream in the tundra, Coville and Kearney (No. 1874).

Seemann in his Botany of the Herald, page 40, reports *Salix richardsoni* as occurring on the Arctic sea coast of Alaska from Kotzebue Sound to Cape Lisburne, but his description of the ovaries as "covered with a slight down" throws doubt on the identification and suggests that they may belong to *Salix pulchra*. The willow from Kadiak reported by Kellogg as *richardsoni* proves to be *pulchra*.

In Hooker's original description the leaves of *Salix richardsoni* are described as "integerrimis." One of the duplicate type specimens from Fort Franklin, in the Columbia University Herbarium, has some partially developed leaves and these show a sparse denticulation precisely as in the Lake Bennett and Port Clarence specimens. The more nearly mature leaves of the Port Clarence plant indicate also that the base is not always as narrow as is shown in the Hooker plate.

7. SALIX BARCLAYI Anders. Barclay Willow.

Plate xxxvi.

Salix barclayi ANDERS. Oefv. Vet. Akad. Foerh. **15**: 125. 1858.
Salix conjuncta BEBB, Bot. Gaz. **13**: 111. 1888.

The commonest bush willow of the Alaskan coast. It is an erect shrub, ordinarily one to two, sometimes three, meters in height, with leaves oblong-obovate, acute or somewhat acuminate at the apex, rounded or wedge-shaped or even cordate at the base, commonly 4 to 7 cm. long, glaucous on the back, smooth or with scant villous or tomentose pubescence which is mostly early deciduous, the stipules ovate or ovate-lanceolate, toothed, persistent, and the ovaries smooth throughout. The characters given in the key distinguish it from related Alaskan species. It ranges throughout the coast region of southern Alaska, from Dixon Entrance northward and westward as far as Unalaska. Southward from Alaska it extends at least as far as the state of Washington. The original specimens of *Salix barclayi* were collected at a point near Cape Greville on Kadiak Island, Alaska, by George Barclay, the botanical collector of the British ship Sulphur, in 1839.

Alaskan specimens of this species have been examined as follows:

Wrangell.—On a hillside back of the town, Coville and Kearney (No. 444), Fernow.

Juneau.—In and near Silver Bow Basin, Coville and Kearney (No. 565), Grace E. Cooley, 1891, F. A. Walpole, 1900 (No. 1053).

White Pass and vicinity.—At various points about Skagway and along the White Pass railroad to Lake Bennett, F. A. Walpole, 1900 (Nos. 1055 to 1057, 1065, 1069, 1261, 1276).

Glacier Bay.—Common on almost all the shores of the bay, Coville

and Kearney (Nos. 623, 641, 652, 660, 700), Trelease and Saunders (Nos. 3406, in part, 3459 to 3461), Trevor Kincaid, 1897.

Yakutat Bay.—Common all about the bay, Coville and Kearney (Nos. 1034, 1046, 1060, 1119, 1139, 1152), Trelease and Saunders (Nos. 3415, 3462, 3466 to 3468, 3471, 3473), Frederick Funston, 1892 (No. 6).

Prince William Sound.—In Port Wells and in Columbia Fiord, Coville and Kearney (Nos. 1260, 1361).

Cook Inlet.—At Kenai, F. A. Walpole, 1900 (No. 1144), and an abnormal form at Halibut Cove, Coville and Kearney (No. 2416a). Also between Cook Inlet and the Tanana River, E. F. Glenn, 1899.

Kadiak Island.—At various points near Kadiak village, Coville and Kearney (Nos. 1436, 2329), Trelease and Saunders (Nos. 3476, 3478, 3479), Fernow, Cole, A. Kellogg, 1867 (Nos. 175, in part, 221, in part), Walter H. Evans, 1897 (Nos. 313, 314), F. A. Walpole, 1900 (Nos. 1149 to 1153, 1158, 1159).

Alaska Peninsula.—At Kukak Bay, Trelease and Saunders (Nos. 3480, 3481).

Shumagin Islands.—On Popof and Unga, Coville and Kearney (No. 1796), Trelease and Saunders (Nos. 3453a, 3455), Kincaid, M. W. Harrington, 1871–2.

Unalaska.—Near Iliuliuk, Coville and Kearney (No. 1785), Fernow, C. Hart Merriam, 1891, J. M. Macoun, 1891, 1896, B. W. Evermann, 1892 (No. 19), Walter H. Evans, 1897 (No. 537).

For remarks on the relationship of this species with *Salix commutata*, see the notes under that species.

8. SALIX COMMUTATA Bebb. Greenbacked Willow.

Plate xxxvii.

Salix commutata Bebb, Bot. Gaz. 13: 110. 1888.

An erect bushy willow commonly .5 to 1.5 meters in height, similar to *Salix barclayi* but distinguishable by the characters given in the key. The most prominent difference lies in the color of the backs of the mature leaves, which in *barclayi* are covered with a conspicuous bloom but in *commutata* have no bloom, but nearly the same green color as the upper surface. The differences in the toothing of the leaf margins of the two species are indicated in the plates. The upper leaves on the leaf shoots of *commutata* often present a grayish appearance, due to a thin but permanent tomentum on both surfaces. The species extends from the coast region of eastern Alaska southward through British Columbia to Oregon, in Alaska not extending west of

Kadiak Island. Mr. Bebb's original specimens were all from the mountains of Oregon and Washington.

The Alaska specimens examined are as follows:

White Pass.—At Log Cabin, Vista, and White Pass, F. A. Walpole, 1900 (Nos. 1066, 1270, 1279).

Glacier Bay.—On the gravels at Muir Glacier, at Hooniah village, Coville and Kearney (Nos. 638, 654), and in Berg Inlet, Kincaid.

Yakutat Bay.—At several points in Disenchantment Bay and Russell Fiord, Coville and Kearney (No. 997), Trelease and Saunders (Nos. 3463, 3464), and on the west side of Yakutat Bay, Coville and Kearney (No. 1118), Fernow.

Prince William Sound.—Incomplete specimens from Port Wells are doubtfully referred here, Coville and Kearney (No. 1274), Trelease and Saunders (No. 3474).

Kadiak Island.—Along a small stream near the summit of the mountain back of Kadiak village, F. A. Walpole, 1900 (No. 1182). Specimens of this willow were brought from a mountain back of English Bay by Miss Harriman, but the specimens unfortunately were not preserved.

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (Nos. 1618, 1680), Trelease and Saunders (No. 3482).

The history of this species, briefly stated, is as follows: In the year 1888 Mr. M. S. Bebb published two closely related new species of willows, *commutata*[1] and *conjuncta*,[2] which he considered intermediate between *glauca* and *cordata*. Later, in the light of further collections, he recognized and alluded to[3] the close relationship of these species with the older *Salix barclayi* of Andersson and his own *Salix californica*.[4] Still later he described[5] *barclayi* as a species exhibiting "a degree of variation remarkable even among willows," and was inclined to refer to it as synonymous his *commutata* and *conjuncta*, an inclination to which he afterward yielded as evidenced by his identifications of willows sent to him from the National Herbarium. From the large series of specimens now available and from field observation of these willows in the Cascade Mountains and in Alaska, I do not hesitate to express the opinion that *Salix barclayi* and *Salix commutata* are two valid species, and that *conjuncta* is a synonym of *barclayi*. No botanist with mature leaf specimens of the two plants be-

[1] Bot. Gaz. 13: 110. 1888.

[2] Idem, 111.

[3] Idem, 16: 106–7. 1891.

[4] Bebb in Brewer & Wats. Bot. Cal. 2: 89. 1880.

[5] Contr. Nat. Herb. 4: 198. 1893.

fore him would unite them, but the young leaves of *barclayi* do not always show the glaucous character of their lower surface, and even the characteristic toothing of the margin is then often obscured also. *Salix californica* may be distinguished from *commutata* by its hairy capsules.

9. SALIX PULCHRA Cham. Diamondleaf Willow.

Plate xxxviii.

Salix pulchra CHAM. Linnaea 6: 543. 1831.
Salix phylicoides ANDERS. Oefv. Vet. Akad. Foerh. 15: 123. 1858.
Salix fulcrata ANDERS. Kongl. Vet. Akad. Handl. IV. 6: 139. 1867.

An erect and bushy, though in arctic or alpine situations often prostrate, willow with diamond-shaped leaves bright green and shining above, glaucous beneath, entirely smooth on both surfaces except when very young, usually entire though sometimes sparingly crenate-denticulate near the middle, the stipules lanceolate, glandular-denticulate, and persistent. It is a trim, handsome species, well deserving Chamisso's name *pulchra*. The original description was based on specimens collected by the Kotzebue expedition at Cape Espenberg in Kotzebue Sound and on St. Lawrence Island in Bering Sea. The species ranges from the coast of eastern Siberia through the islands of Bering Sea to Point Barrow on the Arctic coast of Alaska, to Kadiak Island on the south coast, and to the upper Yukon valley in the interior.

The specimens examined are as follows:

Siberia.—On the coast of Bering Sea, between St. Lawrence and Mechigme bays, James T. White, 1894.

Arctic Seacoast of Alaska.—At Point Barrow, John Murdoch, 1882–3.

Kotzebue Sound.—On the Kowak or Putnam River, G. M. Stoney, 1886.

Port Clarence.—On the tundra, often prostrate, sometimes a meter and a half in height, reaching at least 5 cm. in diameter of trunk, Coville and Kearney (No. 1876), Trelease and Saunders (Nos. 3374 to 3376), Brewer and Coe (Nos. 377, 378), Cole.

St. Lawrence Island.—At Northeast Cape, Coville and Kearney (No. 2001), Trelease and Saunders (No. 3445).

St. Matthew Island.—On St. Matthew, Coville and Kearney (No. 2088) Brewer and Coe (No. 466).

Pribilof Islands.—On St. Paul Island, C. Hart Merriam, 1891.

Shumagin Islands.—Common at sea-level on both Popof and Unga, Coville and Kearney (No. 1796a), Trelease and Saunders (Nos. 3453, 3454, 3454a, 3458), C. H. Townsend, 1893.

Kadiak Island.—A common species, Coville and Kearney (No. 1434), Trelease and Saunders (Nos. 3366, 3475), Brewer and Coe (No. 220), Cole, A. Kellogg, 1867 (No. 221, in part), F. A. Walpole, 1900 (No. 1156).

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (Nos. 1633, 1640). On the Nushagak River, C. L. McKay, 1881.

Yukon Valley.—On Fortymile Creek, near its junction with the Yukon, Frederick Funston, 1893 (No. 40). Junction of Allen and Koyukuk rivers, F. C. Schrader, 1899.

Skagway to *Lake Bennett.*—Collected at various points, F. A. Walpole, 1900 (Nos. 1060, 1061, 1068, 1084, 1085, 1269).

Adelbert von Chamisso, in reporting on the Arctic willows collected by himself and Eschscholtz on the Kotzebue Expedition, describes a willow as follows:

Salix pluries nobis obviam venit, an nova species, *pulchra*, fruticulosa, depressa, foliis breviter petiolatis pollicaribus majoribusque lanceolatis ellipticisve utrinque acutis integerrimis glabris, subtus glaucescentibus, venis pennatis obliquis tenuibus utrinscens [utrinsecus] 5–8 notatis, stipulis lineari-filiformibus serratis, amentis lateralibus sessilibus villosis, femineis maturis crassis circiter bipollicaribus, capsulis lanatis subsessilibus. Habitus fere *Salicis arcticae* Pall.—In Promontorio Espenbergii Americae transbeeringiensis, inque insula Sti. Laurentii.—An eadem, quam sterilem prope Tigil Kamtschatcae occidentalis legit Erman? cui folia majora, latiora, bipollicaria, subinde obovata, venis pluribus primariis utrinsecus 8–10-ornata.[1]

This is an excellent description of a certain willow common in western Alaska, and the description applies to no other species of that region. It is therefore assumed, even in the absence of the type specimens, that Chamisso's *Salix pulchra* is identifiable. The species to which the description applies is the *Salix phylicoides* of Andersson,[2] which was afterward divided by its author so as to make an additional species, *fulcrata*.[3] Mr. M. S. Bebb critically investigated the two in 1888 and pointed out their identity, figuring a series of leaves and fruits.[4] Chamisso's name appears to have been lost sight of, as it is not included in the Index Kewensis, nor is it cited as a published name in any of the works on willows that I have consulted. Andersson alluded to the plant in 1858, when he referred it[5] dubiously to the *S. lapponum* of Linnæus, but likened its leaves to those of the European species *phylicifolia*, a willow so nearly resembling our Alaskan plant

[1] Linnaea **6**: 543. 1831.

[2] Oefv. Vet. Akad. Foerh. **15**: 123. 1858.

[3] Kongl. Vet. Akad. Handl. IV. **6**: 139. 1867.

[4] Bot. Gaz. **13**: 186–7. *pl. 10.* 1888.

[5] Oefv. Vet. Akad. Foerh. **15**: 120. 1858.

that Andersson himself recognized that resemblance in his name *S. phylicoides*.

There is some doubt as to the real type locality of Andersson's *Salix phylicoides*. He said "Hab. in arctica America occidentali (Awatcha Bay: Seeman[n])." Awatcha Bay, however, is not in Alaska but in southern Kamchatka. It is the bay on which the Russian port of Petropavlovsk is situated. The British ship Herald, on which Seemann visited the North Pacific, worked also, however, extensively in Kotzebue Sound and neighboring parts of Arctic Alaska, and it is probable that the type specimens came from that coast.

10. SALIX GLAUCA L. Grayleaf Willow.

Plate xxxix.

Salix glauca L. Sp. Pl. 2: 1019. 1753.
Salix seemannii RYDBERG, Bull. N. Y. Bot. Gard. 2: 164. 1901.

An erect willow, commonly .5 to 1.5 meters high, with entire leaves glaucous on the lower surface and permanently clothed beneath, and the upper ones usually also above, with a rather thin covering of long appressed hairs, the ovaries white-hairy, and the catkin-scales light brown to straw-colored. The plant was originally described from north European material but the species has a circumpolar distribution. In Alaska it ranges from the shores of Bering Sea eastward to the upper Yukon.

Specimens have been examined as follows:

White Pass.—At Bennett and Vista, F. A. Walpole, 1900 (Nos. 1081, 1275).

Glacier Bay.—On the gravels at the Muir Glacier, very scarce, Coville and Kearney (No. 641*a*).

Kadiak Island.—One of the commonest willows about Kadiak village, Coville and Kearney (Nos. 1438, 2248, 2328, 2331), Trelease and Saunders (Nos. 3362, 3367, 3477), Cole, F. A. Walpole, 1900 (Nos. 1155, 1157). At Sturgeon Bay, near Cape Karluk, Trelease and Saunders (No. 3368), Brewer and Coe (No. 482).

Shumagin Islands.—Abundant at Sand Point, Popof Island, and on Unga Island, Coville and Kearney (No. 1800), Trelease and Saunders (Nos. 3369 to 3371), Kincaid, M. W. Harrington, 1871–2, C. H. Townsend, 1893.

Bristol Bay.—Near Nushagak, C. L. McKay, 1881.

St. Michael.—On the mainland opposite the island, Frederick Funston, 1894 (No. 236).

Port Clarence.—Along a stream valley in the tundra, Coville and

Kearney (No. 1875), Trelease and Saunders (No. 3373), Brewer and Coe (No. 380).

Kotzebue Sound.—On Chamisso Island, Berthold Seemann, 1848–1850.

In addition to these localities, the plant is reported from the Upper Yukon valley.

There is a tendency among American willow students to exclude *Salix glauca* from the North American flora, but our Alaskan specimens show so close an agreement with some European material of this species that I am unwilling to separate them. A *Salix seemannii* has been described very recently,[1] the type specimen collected at Dawson, Yukon Territory, by R. S. Williams, June 11, 1899. The species is credited also to Kotzebue and Norton sounds, Alaska, on the basis of collections made by Berthold Seemann. No comparison of the differences between *glauca* and *seemannii* is made by the author, nor am I able to find in the description a record of any characters that serve to distinguish the specimens assigned to the latter species from forms of *glauca* found in America and Europe.

11. SALIX NIPHOCLADA Rydberg. Mouseleaf Willow.

Salix niphoclada RYDBERG, Bull. N. Y. Bot. Gard. 1: 272. 1899.

FIG. 20. *Salix niphoclada* Rydberg: *a*, pistillate flowering twig, natural size; *b*, pistillate flower, enlarged six diameters; *c*, mature leaf, natural size.

An erect bushy willow, at least half a meter in height, the twigs and lower surfaces of the leaves in dried specimens very gray, almost mouse-colored, from their glaucousness and appressed hairs, and the darkening of the tissues in drying. The leaves are oblong-lanceolate to ovate-lanceolate, acute at the apex, rounded or cordate at the base, on petioles 2 mm. or less in length, entire or with a few obsolescent teeth toward the base, commonly 1.5 to 3.5 mm. long, the lower surface very glaucous and, in all except some of the lowermost rudimentary leaves, with a rather sparse, permanent, rather appressed pubescence of somewhat curly hairs, the upper surface green and with a sparse (except in the upper leaves of vigorous twigs) pubescence of longer appressed hairs like those on the twigs. The slender catkins, about 4 to 6 mm. in diameter, are

[1] Rydberg, Bull. N. Y. Bot. Gard. 2: 164. 1901.

borne on branches of the season which are sometimes 2.5 cm. long and commonly bear 3 to 5 leaves. The catkin scales are pale brown to straw-colored, the ovaries white-tomentose, and the styles from .5 mm. long to almost nothing. The plant is a rare one in herbaria, having been collected, so far as known, only near the mouth of the Mackenzie River in British America (the type locality), on the Porcupine River in Alaska, and on the northwestern shore of Hudson Bay.

The specimens examined are as follows:

Mackenzie River.—At a point 30 miles north of the Arctic Circle Miss E. Taylor, 1892.

Porcupine River.—At its junction with the Yukon, growing along the margins of woods, Frederick Funston, 1894 (No. 185).

Hudson Bay.—Near the mouth of Seal River, 40 miles (64 km.) northwest of Fort Churchill, E. A. and A. E. Preble, 1900 (No. 26). Identified by P. A. Rydberg.

Dr. Rydberg based his description on a single fruiting specimen collected by Miss E. Taylor, as above cited, and deposited in the herbarium of the Geological and Natural History Survey of Canada. Mr. Funston's material is in flower and full leaf, and includes both pistillate and staminate specimens. This additional material necessitates a change in the original description in only minor details, all of which are included in the general characterization given above. The staminate catkins in our specimens are about 1 cm. in length, and except the exserted portions of the stamens, about 3 mm. in diameter, with 2 stamens to each flower, the filaments smooth. The nearest relative of the species among Alaskan willows is *Salix glauca*.

12. SALIX ARBUSCULOIDES Anders. Little-tree Willow.

Salix arbusculoides ANDERS. Kongl. Vet. Akad. Handl. IV. **6**: 147. *t. 8. f. 81.* 1867.

Salix humillima ANDERS. in DC. Prod. **16**^{2}: 248. 1868.

An erect shrub with reddish stems and narrowly elliptical-lanceolate leaf-blades acute at both ends, smooth and bright green above, glaucous beneath, the margins finely and closely denticulate throughout, the lower surface with a permanent pubescence of straight, closely appressed rather short hairs. The catkins, which appear with the leaves on short usually leafy-bracted peduncles, are cylindrical and slender, the ovaries pubescent. The species was described from specimens collected in eastern British America at Prince Albert Sound and Rae River; the Labrador locality, also assigned the plant in the original publication, is probably an error. None of the types has been accessible to the

writer, and the present reference of our specimens is based on an identification by Herr Rittmeister von Seemen of the Berlin Herbarium.

Our Yukon Valley specimens are as follows:

Fortymile Creek.—Near the junction of Fortymile Creek with the Yukon River, Frederick Funston, 1893 (No. 42a).

Dawson.—"Island near footbridge," R. S. Williams, 1899.

Fiftymile River.—Collected by Arthur L. Bolton, 1899.

Salix arbusculoides most resembles, among Alaskan willows, *Salix sitchensis*, but the toothing and less distinctly oblanceolate character of the leaves, the lack of the permanent satiny lustre of the lower leaf surface, and the presence of two stamens instead of a single stamen in the male flowers, distinguish *arbusculoides*. *Salix sericea* Marsh., of the eastern United States, is another species resembling *arbusculoides* but its leaves are slightly hairy on the upper surface, at least on the midrib, and the apex is acuminate, while the catkins are more densely flowered than those of *arbusculoides*, with the scales usually black, and rather densely villous. In *arbusculoides* the leaves are entirely smooth above, even to the midrib, and the apex is merely acute, the point sometimes blunt; and the catkins are more loosely flowered, he scales light to dark brown, scarcely black, sparingly villous. The willow described by von Seemen in 1895 as *Salix saskatchavana*[1] seems to be closely related to *Salix arbusculoides* but the statement regarding the leaves, "untere Seite in der Jugend fein seidig behaart, im ausgewachsenen Zustande *beide Seiten kahl*," furnishes the presumption of a specific distinction.

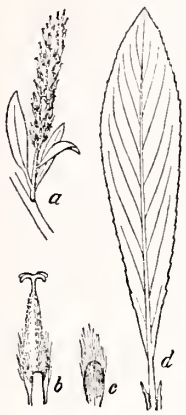

FIG. 21. *Salix arbusculoides* Anders.: *a*, pistillate flowering twig, natural size; *b*, pistillate flower, enlarged six diameters; *c*, scale, same enlargement; *d*, mature leaf, natural size.

In addition to the flowering specimens collected by Mr. Funston mature leaves and fruit were collected at Dawson, Yukon Territory, June 19, 1899, by Mr. R. S. Williams, and similar mature specimens at Fiftymile River, Yukon Territory, in the same year, by Mr. Arthur L. Bolton. From the upper Yukon the species extends eastward nearly or quite across the northern part of the continent. None of these collectors described the habit of the plant, but it certainly is not a prostrate species, and doubtless is not a tree.

[1] Seemen, Engl. Bot. Jahrb. Beibl. 52: 7. 1895.

13. SALIX MYRTILLIFOLIA Anders. Myrtle Willow.

Salix myrtillifolia ANDERS. Oefv. Kongl. Vet. Akad. Foerh. **15**: 132. 1858. Also ANDERS. Proc. Am. Acad. **4**: 74. 1858.

A small, trailing, rather than prostrate, willow, the branches often standing erect for a decimeter or two above the ground. The leaf-blades in our specimens are oblong, 1 to 2 cm. in length, broadly acute or obtuse at base and apex, entirely smooth, evenly crenate about the whole margin, on smooth petioles about 1.5 to 3 mm. in length. The catkins appear with the leaves from lateral buds on old wood, the short pubescent peduncles, 1 to 3 mm. in length, bearing usually 2 to 3 small leaves. The pistillate catkins are 1 to 2 cm. in length, and about 4 to 5 mm. in diameter, the scales short, black-tipped, and sparingly hairy. The ovaries are smooth, lanceolate, tapering into a short style .5 mm. or less in length, the pedicel about twice or three times the length of the nectary and only a little shorter than the catkin scales. The species is known only from the interior of British America, the type specimens being marked "Rocky Mountains, east side, low situations." It has been found so close, however, to the Alaskan boundary, namely on the shores of Lake Bennett, Yukon, J. B. Tarleton, 1899 (Nos. 4a, 4b), and below White Horse Rapids, R. S. Williams, 1899, that its occurrence in Alaska may be expected.

FIG. 22. *Salix myrtillifolia* Anders.: *a*, pistillate flowering twig, natural size; *b*, pistillate flower, enlarged six diameters; *c*, leaf, natural size.

From lack of specimens it has been impossible to give this species the critical study it needs, particularly in the direction of establishing its relationship to *Salix pseudomyrsinites* and *Salix curtiflora*. These were published as species by Andersson in the same paper in which *myrtillifolia* was published, but he afterward brought all three together as varieties of his *Salix novaeangliae*, a treatment which has not been followed by recent American students of Salices.

14. SALIX CHAMISSONIS Anders. Chamisso Willow.

Salix chamissonis ANDERS. in DC. Prod. **16**[2]: 290 1868.

A prostrate willow with obovate smooth leaves minutely and closely glandular-serrate about the entire margin. It is the only normally prostrate willow of Alaska with glandular-serrate stipules. Its creeping branches and bright green leaves form rather dense patches in moist

places in the tundra. The plant is confined to the truly Arctic zone on the islands and shores of the northern part of Bering Sea, the original specimens having been collected by Chamisso and Eschscholtz, botanists of the Kotzebue Expedition, in 1816, at St. Lawrence Bay, on the Siberian side of Bering Strait, about latitude 65° 40′.

FIG. 23. *Salix chamissonis* Anders., a mature leaf, natural size.

Specimens have been examined as follows:

Port Clarence.—Abundant on the tundra of the mainland at the landing place of the expedition, Coville and Kearney (Nos. 1877, 1878, 1879), Trelease and Saunders (No. 3472), Cole.

St. Lawrence Island.—Found sparingly on the tundra at Northeast Cape, Coville and Kearney (No. 2003). The plant was also collected on this island by Chamisso and Eschscholtz, according to Ledebour, and by Kjellmann, of the Vega Expedition.

Siberian Coast.—Collected at Plover Bay by W. H. Dall, of the Western Union Telegraph Expedition, in 1865–6.

This species is easily distinguishable from the other prostrate willows of Alaska by the form and serration of its leaf-blades. These are commonly 1.5 to 3 cm. in length, narrowly obovate to nearly orbicular, apiculate, broadly acute or rounded at the apex, and either glaucous or shining beneath. The catkins, which stand erect on leafy peduncles, are a centimeter or a little more in diameter and commonly 3 to 6 times as long. In most of the specimens the capsules are distinctly but not densely pubescent, but in some they are smooth. The style is about a millimeter in length.

15. SALIX ARCTICA Pallas. Arctic Willow.

Plate XL.

Salix arctica PALL. Fl. Ross. 1[2]: 86. 1788.
Salix diplodictya TRAUTV. Nouv. Mem. Soc. Nat. Mosc. 2: 307. *t. 14.* 1832.
Salix crassijulis TREV.; TRAUTV. Nouv. Mem. Soc. Nat. Mosc. 2: 308. *t. 15.* 1832.
Salix pallasii ANDERS. in DC. Prod. 16[2]: 285. 1868.

The commonest and the largest of the prostrate willows of Alaska. Its short half buried trunk is sometimes 2 to 3 cm. in diameter, and sends out stout horizontal creeping branches sometimes a centimeter thick at the base. Its leaf blades are normally about 2.5 to 4 cm. long, obovate, obtuse at the apex, tapering at the base, glaucous beneath, entire, or

very sparingly denticulate toward the base, smooth on both sides at maturity, but usually with some long soft appressed hairs on the margins and lower surface when young. Sometimes, however, the leaf-blades are almost orbicular with a scarcely tapering base, sometimes the apex is acute, sometimes retuse, and in robust specimens they may reach a length of 7.5cm., often then developing ovate-lanceolate entire stipules. It is the only prostrate willow of Alaska, except *chamissonis*, that produces stipules, and in that species the stipules are glandular-serrate. Occasionally the upper surface of the leaves bears some cob-webby hairs, even till maturity. A conspicuous feature of the plant when growing is the long, erect, stout, hairy catkins standing above the leaves, which look like little cat tails. The catkin scales are usually black, obtuse, and long-hairy, the ovaries densely white-woolly, becoming more thinly tomentose as they expand and mature, and the styles are commonly 1 to 2 mm. in length. The plant is an arctic-alpine species occurring near timber line, or in cold situations at lower elevations, along the southern coast of Alaska from Juneau westward to the Siberian coast, and northward to the coast of the Arctic Ocean. The original specimens of *arctica* were collected by Sujef in Siberia along the Gulf of Obi, of *diplodictya* on St. Lawrence Island, Bering Sea, and of *crassijulis* in St. Lawrence Bay, Siberia.

A large number of specimens have been examined, as follows:

Juneau.—Above Silver Bow Basin, Grace E. Cooley, 1891.

White Pass.—Near the summit, altitude about 3000 feet, Coville and Kearney (No. 518), Trelease and Saunders (No. 3399), R. S. Williams, 1899, F. A. Walpole, 1900 (Nos. 1104, 1109, 1248, 1278).

Glacier Bay.—At various points, Coville and Kearney (Nos. 621, in part, 625, 655), Trelease and Saunders (Nos. 3400, 3401, 3401a, 3402 to 3405, 3407 to 3409, 3433, in part), Brewer and Coe (Nos. 37, 41), Kincaid, Walter H. Evans, 1897 (No. 157). Most of these specimens were collected on the cold glacial gravels near sea level, the timber line belt being deeply covered with snow at the time of our visit.

Yakutat Bay.—At various localities, Coville and Kearney (Nos. 1001 to 1003, 1013, 1040, 1076, 1082, 1099, 1140), Trelease and Saunders (Nos. 3410, 3411, 3414, 3441, 3472), Frederick Funston, 1892 (No. 117). Most of these specimens were collected on glacial gravels near sea level.

Prince William Sound.—At several localities, Coville and Kearney (Nos. 1195, 1271, 1362), Trelease and Saunders (Nos. 3416 to 3418). Some of these grew at sea level, others at 2500 feet elevation.

Kadiak Island.—At various points, Coville and Kearney (No. 1472), Trelease and Saunders (Nos. 3419 to 3421), Brewer and Coe (Nos. 206, 232), Cole, Walter H. Evans, 1897 (Nos. 437 to 439), F. A. Walpole, 1900 (Nos. 1168, 1169).

Shumagin Islands.—At several localities on Popof and Unga, Trelease and Saunders (Nos. 3423, 3424, 3456, 3457), Brewer and Coe (No. 280), Kincaid, M. W. Harrington, 1871–2. On Nagai Island, C. H. Townsend, 1893.

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (No. 1670), Trelease and Saunders (No. 3422), Kincaid. At Stepovak Bay, Palache. At Bailey Harbor, Belkofski Bay, C. H. Townsend, 1893. At Nushagak, without collector's name, 1882.

Aleutian Islands.—On Akun Island, C. H. Townsend, 1893. On Unalaska, Coville and Kearney (Nos. 1786a, 2200), Trelease and Saunders (No. 3426), Brewer and Coe (No. 296), Cole, H. G. von Langsdorff, 1805–6, A. Kellogg, 1867 (No. 275), M. W. Harrington, 1871–2, L. M. Turner, 1880, C. Hart Merriam, 1891, J. M. Macoun, 1891, B. W. Evermann, 1892, Walter H. Evans, 1897 (No. 537, in part). On Attu Island, J. M. Macoun, 1891, W. V. E. Jacobs, 1894.

Pribilof Islands.—On St. Paul, Robert White, 1879, William Palmer, 1890 (Nos. 310, in part, 425, 724), C. Hart Merriam, 1891, J. M. Macoun, 1892, 1897, C. H. Townsend, 1893, Trevor Kincaid, 1897.

St. Matthew Islands.—On St. Matthew, Coville and Kearney (No. 2086), Trelease and Saunders (Nos. 3394, 3430, 3431, 3447). On Hall Island, Coville and Kearney (No. 2082), Trelease and Saunders (Nos. 3428, 3429, 3446), Brewer and Coe (No. 410), J. M. Macoun, 1891.

Arctic Seacoast.—Collected at Point Hope by some person on the Revenue Cutter Corwin in 1883.

Siberia.—At Plover Bay, Coville and Kearney (No. 1865), Cole, W. H. Dall, 1865–6. On Bering Island, L. Stejneger, 1882–3.

Salix arctica is exceedingly variable in its leaf characters, and this, together with certain nomenclatorial accidents, has caused the species to be known under several different names. Mr. M. S. Bebb published a critical statement on the subject in 1889,[1] based in part on correspondence with Trautvetter, which I have here followed. The large number of specimens examined tends to confirm the idea that the extreme variation in the leaves is chiefly an individual characteristic and does not mark recognizable incipient species. The nearest ap-

[1] Bot. Gaz. 14: 115–17. 1889.

proach I have found to a subspecific differentiation is in some of the specimens from the Pribilof and St. Matthew Islands in Bering Sea, and the Shumagin Islands. In these specimens the leaves are orbicular or nearly so and only about 2 to 3 cm. in diameter, while the catkins are shorter than usual, about 1.5 to 3.5 cm. in length. Occasionally specimens are found which lack the glaucousness of the lower leaf surface, a character on which Trautvetter based chiefly his separation of *diplodictya*.

16. SALIX GLACIALIS Anders. Icy Willow.

Salix glacialis ANDERS. Oefv. Vet. Akad. Foerh. **15**: 131. 1858.

A prostrate willow with smooth stems and buds, small oval obtuse leaves 12 mm. or less in length, smooth, or when young slightly appressed-villous on the lower surface, glaucous on the back, entire or with a few teeth toward the base, the catkins ovoid to globose, several-flowered, the scales black and nearly smooth on the outside, the ovaries densely white hairy, and the style wanting. Its foliage resembles that of *ovalifolia*, though smaller, but in the pistillate flowers it is very different from any species of the *ovalifolia* group.

FIG. 24. *Salix glacialis* Anders.: *a*, pistillate flowering twig, natural size: *b*, pistillate flower, enlarged six diameters.

The species is known only from the type specimen collected by Lieutenant W. J. S. Pullen, in 1849, on the Arctic seacoast between Point Barrow and the Mackenzie River, and from specimens collected at Point Barrow by John Murdoch, in 1882–3. Staminate specimens and mature leaves are unknown.

17. SALIX FUSCESCENS Anders. Bog Willow.

Salix fuscescens ANDERS. Kongl. Vet. Akad. Handl. IV. 6: 97. 1867.

A prostrate or trailing willow, with small smooth leaves glossy above, glaucous beneath, of a rhombic-obovate form, the broadest part distinctly above the middle, and usually with a few teeth toward the narrowed base, the ovaries smooth, styles less than half a millimeter in length, and the pedicels two or more times the length of the nectaries. It is a species of western Alaska, occurring from the peat bogs of Kadiak Island and Cook Inlet westward to the tundra of the shores and islands of Bering Sea and the Arctic Ocean, and is found also in eastern Siberia.

Specimens have been examined as follows:

Cook Inlet.—In bogs at Kasilof, Walter H. Evans, 1898 (Nos. 682, 726).

Kadiak Island.—In a bog at the head of a lake about a mile and a half from the village of Kadiak, F. A. Walpole, 1900.

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (No. 1660).

Norton Sound.—At Unalaklik, Frederick Funston, 1894 (No. 232).

St. Lawrence Island.—On the marshy tundra at Northeast Cape, Coville and Kearney (No. 2002), Trelease and Saunders (Nos. 3443, in part, 3444), Cole.

St. Matthew Island.—On the tundra, Coville and Kearney (No. 2087a).

Siberian Coast.—At Plover Bay, W. H. Dall, 1865–6, Coville and Kearney (No. 1856), Cole.

In his original description Andersson gave the range of this species as "in Kamtschatka (Beechy et Mertens), ad Alaxa (Kostalski), ad ostium fl. Uda, ad sinus Manga, Nichta, Ujakon, et in insula Schantar (Middend.)," and he found it also among the Kotzebue plants from Eschscholtz Bay and Shishmaref Bay or Inlet, in Kotzebue Sound. It has been impossible to consult any of these specimens, and our identifications of the species rests on descriptions alone. In Hooker and Arnott's Botany of Captain Beechey's Voyage and various subsequent publications the species was misidentified as *S. rhamnifolia* Pallas. Among the Alaskan species *fuscescens* most nearly resembles *ovalifolia*, but may readily be distinguished by the characters given in the key. Its nearest relative among North American willows is *Salix myrtilloides* L., a circumpolar species occurring on our continent chiefly on the eastern side, in bogs, and apparently not extending northwestward to Alaska. The name *fuscescens* was given to the plant to indicate the tendency of the young leaves to turn blackish in drying, a phenomenon characteristic, however, of several other species of willows.

FIG. 25. *Salix fuscescens* Anders.: *a*, pistillate flowering twig, natural size; *b*, pistillate flower, enlarged six diameters; *c*, mature leaf, natural size.

18. SALIX OVALIFOLIA Trautv. Oval Willow.

Salix ovalifolia TRAUTV. Nouv. Mem. Soc. Nat. Mosc. 2 : 306. *t. 13.* 1832.
Salix unalaschcensis CHAM.; ANDERS. Oefv. Kongl. Vet. Akad. Foerh. 15 : 130. 1858.
Salix rotundata RYDBERG; JORDAN, Fur Seal Islands 3 : 571. 1899, not *Salix rotundata* FORBES 1829.
Salix cyclophylla RYDBERG, Bull. N. Y. Bot. Gard. 1 : 274. 1899.

A common and characteristic prostrate willow of western Alaska and eastern Siberia, extending in Alaska along the coast from the Shumagin Islands westward to the Aleutian Islands, northward through the islands and shores of Bering Sea, and northeastward along the Arctic Ocean to Point Barrow. The type specimen of *ovalifolia* came from Cape Espenberg, Kotzebue Sound, of *unalaschcensis* from Unalaska, of *rotundata* and *cyclophylla* from St. Paul Island, of the Pribilof group. It is distinguishable from the other prostrate willows of Alaska by its oval to orbicular, nearly or quite entire leaves usually 10 to 20, or sometimes even 25, mm. in length, glaucous beneath, and at maturity thick, tough, and prominently marked beneath by a net-work of fine veins, its slender shoots of the season running over the surface of the ground, its smooth and glaucous capsules on stalks little or not at all exceeding the nectaries, and its styles about .5 mm. in length. It forms large carpet-like patches in the grass, extending to sea level, apparently, in the southernmost parts of its range and reaching therefore below the limits of most strictly arctic plants.

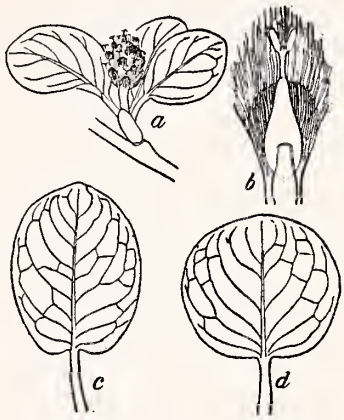

Fig. 26. *Salix ovalifolia* Trautv.: *a*, pistillate flowering twig, natural size; *b*, pistillate flower, enlarged six diameters; *c*, *d*, mature leaves, natural size.

Specimens have been examined as follows:

Yakutat Bay.—On the glacial gravels along the west shore of the bay, only a single patch seen, Coville and Kearney (No. 1141). Although this locality is far to the east of the main range of the species, the specimens have the characteristic long creeping shoots and glaucous capsules. The fact that only a single patch was observed, close to the bank of a stream, suggests that a stray seed may have been brought to the spot by the wind or some water bird. It is quite possible, too, that *Salix ovalifolia* occurs at several points east of Kadiak, for the

limited character of the collections thus far made in Cook Inlet and Prince William Sound do not preclude the possibility of its occurrence in those places.

Kadiak Island.—Mountain back of Kadiak village, F. A. Walpole, 1900 (No. 1227).

Alaska Peninsula.—Collected in Stepovak Bay, where it was rather abundant, Palache.

Shumagin Islands.—At Sand Point, Popof Island, Coville and Kearney (No. 1799), and elsewhere on the same island, Trelease and Saunders (No. 3425).

Pribilof Islands.—Abundant and forming large mats near the village of St. Paul, St. Paul Island, Coville and Kearney (No. 1837), Trelease and Saunders (No. 3442), Kincaid, Cole, Brewer and Coe (Nos. 325, 329), Mrs. Bryant, 1875, William Palmer, 1890 (Nos. 353, 424, 556), C. H. Townsend, 1893, J. M. Macoun, 1897.

St. Matthew Islands.—On St. Matthew Island, Coville and Kearney (No. 2087), Trelease and Saunders (No. 3448), Brewer and Coe (No. 469). On Hall Island, Coville and Kearney (Nos. 2084, 2085).

St. Lawrence Island.—At Northeast Cape, Trelease and Saunders (No. 3443), Cole.

Point Barrow.—Collected by John Murdoch, 1882–3 (No. 65).

Siberian Coast.—At Kayne, or Arakamtchechene, Island, collected on the Ringgold and Rodgers U. S. North Pacific Exploring Expedition, C. Wright, 1853–6.

Various other collections of the plant have been made about Bering Sea and north of Bering Strait along the Arctic coast of Alaska, the easternmost record, between Point Barrow and the Mackenzie River, resting on a specimen collected by Lieutenant W. J. S. Pullen, in 1849.

The name *Salix unalaschcensis* which is often cited as published by Chamisso in 1831,[1] can not properly, it seems to the writer, be cited as of that date, the word *unalaschcensis* being merely the first word in a Latin note on a willow to which Chamisso did not give a name. In another precisely similar case he began "Salix ad portum Sancti Francisci." It evidently did not occur to Ledebour that the word had any nomenclatorial intent or value for he did not cite it in his Flora Rossica. The first use of *Salix unalaschcensis* in such a way as to give it standing in nomenclature appears to be Andersson's citation of it in 1858, as given above. He at that time referred it doubtfully to the plant we now know as *Salix fuscescens* Anders. Later, in 1868,[2] he referred it to *Salix ovalifolia*, the species, and the

[1] Cham. Linnaea **6**: 541. 1831. [2] Anders. in DC. Prod. **16²**: 291. 1868.

only species, with which Chamisso's description agrees. Dr. Rydberg's recent application of Chamisso's name *unalaschcensis* to a prostrate willow of the Juneau district of eastern Alaska is discussed under *Salix stolonifera*.

Dr. Rydberg's *Salix rotundata*, a homonym for which he afterward substituted the name *Salix cyclophylla*, as cited above, I am unable to distinguish from *ovalifolia* except as a common, and perhaps indeed the prevalent, form with orbicular instead of oval leaves. Both forms of leaves occur sometimes on the same plant, and all the other characters that distinguish the oval-leaved *ovalifolia* from other willows are found also in the orbicular-leaved plant.

19. SALIX STOLONIFERA Coville. Sprouting Willow.

Plate XLI, Figure 1.

Salix stolonifera sp. nov.

Plant prostrate; branches of the season smooth, 1 to 2 mm. in diameter, the underground portions of old stems frequently developing slender subterranean ascending branches or stolons, usually less than a millimeter in diameter; leaf blades commonly 1.5 to 3 cm. long, oval to obovate, rounded or sometimes broadly acute at the apex, either wedge-shaped or rounded at the base, sparingly provided when young with a few early deciduous long straight hairs on the margins and back, entire or with a few teeth near the petiole, glaucous beneath and the reticulations not very conspicuous; catkins terminating leafy branches of the season, oblong to cylindrical; scales black, obovate, rounded at the apex, rather sparingly provided on both surfaces with long straight white hairs inclined to be deciduous; stamens two to each scale, the filaments smooth; ovary smooth or with some traces of pubescence toward the apex, lanceolate, its stalk shorter than the nectary, the style 1.5 to 2 mm. long, each of the stigmas bifid into two linear segments; capsule not glaucous.

Type specimens in the United States National Herbarium, collected June 10, 1900, at the railway station of Glacier, between Skagway and White Pass, Alaska, by F. A. Walpole (No. 1075).

The nearest relative of *Salix stolonifera* in Alaska is *Salix ovalifolia*. The characteristic of the production of slender, leafless, subterranean branches or stolons, which the specimens of *stolonifera* usually show, I have never detected in *ovalifolia*. The length of the styles is perhaps the easiest diagnostic character for one not familiar with the two species. The leaves of *stolonifera* while similar in form

and size to those of *ovalifolia* have the reticulations of the veins much less conspicuous on the back at maturity, and the capsules of *stolonifera* are not glaucous. *Salix ovalifolia* is a characteristic species of the Bering Sea and Alaska Peninsula region, though found sparingly to the eastward as far as Yakutat Bay, while *stolonifera* is a species of eastern Alaska, in the glacier region from Yakutat Bay to Glacier Bay and Lynn Canal.

Stolonifera is evidently the species to which Dr. Rydberg has recently applied, mistakenly as I believe, the name *unalaschcensis* of Chamisso.[1] From the original description of Chamisso[2] the following characters of *unalaschcensis* are abstracted: plant prostrate, with branches a foot long; leaves obovate, subglaucous beneath, entire (this last character drawn by inference from Chamisso's comparison of his plant with *Salix arctica* Pall.); ovaries smooth. This would identify the plant with *ovalifolia*, or *fuscescens*, or *stolonifera*. The additional character "stylo elongato" excludes *fuscescens*, and it is doubtless this same phrase that led Dr. Rydberg to identify Chamisso's plant with the very long-styled *stolonifera*. But as *stolonifera* is not known within more than a thousand miles of Unalaska, as the long creeping branches are characteristic of *ovalifolia*, while they are not characteristic of *stolonifera*, and as "elongated" is a relative term, it is reasonable to conclude that Chamisso had in hand not *stolonifera* but *ovalifolia*. For further remarks on the name *Salix unalaschcensis*, see the account of *Salix ovalifolia*.

Specimens of *stolonifera* have been examined as follows:

Juneau.—From the mountains above Silver Bow Basin, Grace E. Cooley, 1891. From the mountains east of Juneau, at an altitude of 2500 to 3000 feet, F. A. Walpole, 1900 (Nos. 1232, 1242).

White Pass.—From the summit of White Pass, about 3000 feet altitude, R. S. Williams, 1899, F. A. Walpole, 1900 (No. 1249), and at the railway station of Glacier, between Skagway and White Pass (No. 1075).

Glacier Bay.—On the gravel deposits near the foot of Muir Glacier, Coville and Kearney (Nos. 621a, 627), Trelease and Saunders (Nos. 3433, in part, 3434, 3435, in part, 3437, 3439, 3449 to 3452), Brewer and Coe (No. 51), Walter H. Evans, 1897 (No. 158).

Yakutat Bay.—Near Hidden Glacier, Trelease and Saunders (Nos. 3412, 3413). At Hubbard Glacier, Coville and Kearney (No. 1079).

[1] Rydberg, Bull. N. Y. Bot. Gard. 1: 275. 1899.

[2] Cham. Linnaea 6: 541. 1831.

20. SALIX POLARIS Wahl. Polar Willow.

Salix polaris WAHL. Fl. Lap. 261. *t.* 13. 1812.

A very small prostrate willow with stems imbedded in the ground, oval to orbicular-obovate, entire or nearly entire, smooth, deciduous leaves bright green on both surfaces or somewhat glaucous beneath, commonly 1 to 1.5 cm. long, the oblong to globose pistillate catkins few-flowered, with pubescent or partly smooth ovaries and capsules. It resembles in size and general appearance both *leiocarpa* and *phlebophylla*, but it has shorter catkins than the latter and lacks its persistent skeletonizing leaves. These organs too are less tapering at the base in *polaris* and seem to be wholly devoid of the long hairs often present on the margins in *phlebophylla*. In its slender naked stoloniform stems, imbedded in the ground and rooting, it resembles *leiocarpa*, but that species has smooth capsules and its leaves are smaller and more uniformly orbicular, never glaucous on the back, and inclined to be persistent. In the Alaskan region the species, so far as known, is confined to the Arctic zone, about the shores of the northern part of Bering Sea. It was described originally from Lapland and afterward found in northern Asia.

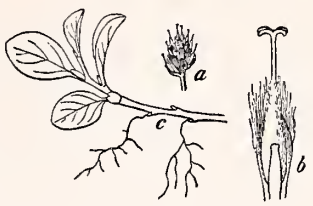

FIG. 27. *Salix polaris* Wahl.: *a*, pistillate catkin, natural size; *b*, pistillate flower, enlarged six diameters; *c*, leafy branch, natural size.

The following specimens, in addition to European ones, have been examined:

Port Clarence.—On the tundra, Trelease and Saunders (No. 3387, 3385, in part). Reported by Lundstrom also as collected here by the Vega Expedition.

Siberian Coast.—On Kayne, or Arakamtchechene, Island, collected on the Ringgold and Rodgers U. S. Exploring Expedition, C. Wright, 1853–6.

Cape Vancouver.—Collected by J. M. Macoun, 1891.

Our specimens of this plant are few and not sufficiently ample to furnish a comprehensive idea of the form of the leaves and the character of the fruit in Alaskan *polaris*. This species was reported from Alaska by several of the early expeditions but it is probable that most if not all these early collections were either *leiocarpa* or *phlebophylla*. Mr. M. S. Bebb in preparing the list of North American willows for

Patterson's Checklist in 1892 omitted *Salix polaris*. Our material, however, though fragmentary and unsatisfactory, makes it probable that the species should again be considered a member of the North American flora. Dr. Rydberg has already taken this view by identifying Mr. Macoun's Cape Vancouver specimen as *Salix polaris*.

21. SALIX PHLEBOPHYLLA Anders. Skeleton Willow.

Salix buxifolia Trev.; Trautv. Nouv. Mem. Soc. Nat. Mosc. **2**: 301. *t.* 10. 1832, not Schleich. 1815.
Salix arctica minor Ledeb. Fl. Ross. **3**: 619. 1849–51, not *Salix arbuscula minor* Laest. 1845.
Salix phlebophylla Anders. Oefv. Kongl. Vet. Akad. Foerh. **15**: 131. 1858.
Salix palaeoneura Rydberg, Bull. N. Y. Bot. Gard. **1**: 267. 1899.

A handsome little willow growing in mats on the ground, well distinguished from other Alaskan willows by the characters given in the key. As in *leiocarpa*, the bright green leaves are covered on both surfaces with minute light-colored dots, visible under a lens, each of which marks the position of a breathing pore. The ovaries and capsules are usually pubescent, though sometimes specimens are found in which nearly the whole surface is entirely smooth. The venation of the leaves is striking. On each side of the midrib are from 3 to 6 conspicuous nerves nearly parallel with the margin but running into it toward the apex. These principal nerves are connected with each other by several cross nerves. After the growing season the leaves die but remain attached to the stems, the tissue between the nerves of the leaf becoming translucent, and by the third season waste away, leaving the skeletonized framework to clothe and protect the stems for several years. In *leiocarpa* the nerves are equally conspicuous but the leaves are not very persistent after the second season and they do not so regularly become skeletonized. The stems of *phlebophylla* are stouter than those of *leiocarpa*, are less completely imbedded in the soil, and do not so often form stolons. The plant grows on the tundra, and occurs along probably the whole Arctic coast of Alaska from the British boundary to Kotzebue and Norton sounds.

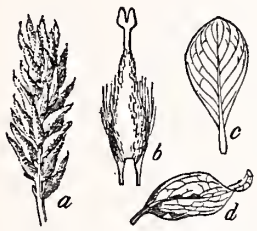

Fig. 28. *Salix phlebophylla* Anders.: *a*, fruiting catkin, natural size; *b*, pistillate flower, enlarged six diameters; *c*, leaf, natural size; *d*, old leaf, skeletonized, natural size.

Specimens examined.

Siberian coast.—On Kayne, or Arakamtchechene, Island, collected

by the Ringgold and Rodgers U. S. North Pacific Exploring Expedition, C. Wright, 1853–6.

Port Clarence.—On the tundra of the mainland at sea level, Coville and Kearney (No. 1873), Trelease and Saunders (Nos. 3385, in part, 3386, 3388, 3389), Brewer and Coe (No. 379).

Point Barrow.—At sea level, John Murdoch, 1882–3 (Nos. 6, 97).

Porcupine River.—Without special locality, J. H. Turner, 1891.

Under the names *Salix retusa* L. and *Salix anglorum* Cham. this willow has been reported from St. Lawrence Island in Bering Sea, St. Lawrence Bay on the Siberian side of Bering Strait, from Chamisso Island and other points in Kotzebue Sound, and from Pelly Isle at the mouth of the Mackenzie.

S. phlebophylla was published by Andersson in 1858 through the citation of an earlier published description, namely, that given under the name *Salix retusa* by Hooker, Fl. Bor. Am. 2: 153. 1838–9. Hooker cited two specimens, one collected in Kotzebue Sound, Alaska, by the botanists of Captain Beechey's expedition, the other on the Arctic seashore of British America by Richardson. A misunderstanding of the species *phlebophylla* on the part of some authors, has been occasioned by the fact that Andersson referred to *phlebophylla* other specimens which did not in reality belong to the plant described by Hooker as "a very distinct and beautiful species, with glossy, strongly nerved, perennial leaves, the skeleton nerves remaining in the lower parts of the stem." Andersson further complicated the matter when he separated his complex *phlebophylla* into three forms, by describing each of them as having "capsulae glaberrimae." Both these mistakes, however, were corrected by Andersson ten years later, when he described *phlebophylla* as having "capsulis . . . tenuiter puberulis" and "foliis coriaceis nitidis sub lente puncticulatis . . . utrinque nervoso-costatis, tertio anno in reticulum cancellatum ob parenchyma evanescens solutis."[1] By these means Andersson clearly restricted the use of the name *phlebophylla* to the plant to which I have here applied it. Dr. P. A. Rydberg has recently[2] referred to *phlebophylla* several specimens of willow with the lower surface of the leaves glaucous. These do not belong to the skeleton-leaved species with which we are now dealing, and this latter plant being therefore apparently left without a name Dr. Rydberg described it as *Salix palaeoneura*,[3] basing his description on specimens

[1] Anders. in DC. Prod. 16[2]: 290–91. 1868.

[2] Rydberg, Bull. N. Y. Bot. Gard. 1: 275. 1899.

[3] Rydberg, Bull. N. Y. Bot. Gard. 1: 267. 1899.

collected at Point Barrow by Murdoch. This disposal of the name *phlebophylla* and the consequent redescription of the skeleton-leaved plant under the name *palaeoneura* is clearly inadmissible for the reasons given above, and furthermore because the specimen in the Columbia University Herbarium marked "No. 96 Herb. H[ooker]," which Dr. Rydberg has cited as the type of *phlebophylla*, although a mere fragment consisting of a fruiting catkin and a single leaf, is identical with our skeleton-leaved plant.

It is of interest to note that Trautvetter in his original description of this plant under the name *buxifolia*, the type of which came from St. Lawrence Island, Bering Sea, calls attention particularly to the skeletonizing of the old leaves: "Folia . . . anno primo haud articulis solvuntur, sed marcescunt, fusca evadunt, quo statu per secundum annum plantae adhaerent, tertio vero foliorum parenchyma evanescit reteque venosum cancellatum foliorum plures adhuc annos persistit . . . Species foliis edurantibus notabilis."[1]

The name *Salix anglorum* Cham.[2] has sometimes been used for this species because the specimens of Chamisso and Eschscholtz identified as *Salix anglorum* by Chamisso are identical with Andersson's *phlebophylla*. Dr. Rydberg has pointed out,[3] however, that Chamisso did not describe the species but cited Robert Brown's *Salix arctica*, a species of eastern Arctic America to which the name *anglorum* must therefore attach.

A plant which has sometimes been confused with *phlebophylla*, but which is readily distinguishable by its promptly deciduous leaves, often glaucous beneath, is referred to in the present paper under the name *polaris*.

22. SALIX LEIOCARPA (Cham.) Coville. Least Willow.

Plate XLI, Figure 2.

Salix polaris leiocarpa CHAM. Linnaea 6: 542. 1831.
Salix rotundifolia TRAUTV. Nouv. Mem. Soc. Nat. Mosc. 2: 304. *t.* 11. 1832.

This charming little plant is the smallest of the Alaskan willows. It forms close tufts or cushions, the very slender stoloniform stems imbedded in the soil, and the leaves, orbicular, smooth, entire, bright green on both surfaces, from a few millimeters to a centimeter in diameter, rising a centimeter or two above the surface. The type

[1] Trautv. Nouv. Mem. Soc. Nat. Mosc. 2: 302–303. 1832.
[2] Cham. Linnaea 6: 541. 1831.
[3] Rydberg, Bull. N. Y. Bot. Gard. 1: 266. 1899.

specimens of *leiocarpa* were collected on the island of Unalaska and at St. Lawrence Bay, Siberia, about latitude 65° 40′. It grows on the islands and both shores of Bering Sea and the Arctic Ocean, and above timber line on the Pacific coast of Alaska eastward to Prince William Sound, preferring not a wet soil, like most willows, but a well drained humus intermixed with finely broken rock. The little pistillate catkins, barely projecting from the tuft of leaves at the ends of the stems, bear commonly 2 to 4, or occasionally 6 to 8 flowers, the ovaries and capsules entirely smooth.

The specimens examined are as follows:

Prince William Sound.—Above timber line on the large, partly forested nunatak of the Columbia Glacier, Coville and Kearney (No. 1364).

Kadiak Island.—Above the alder line on a mountain back of English Bay, Coville and Kearney (No. 1475), F. A. Walpole, 1900 (No. 1226).

Shumagin Islands.—Popof Island, from 800 to 1500 feet elevation, Trelease and Saunders (No. 3380), Kincaid, and at similar elevations on Unga Island, Trelease and Saunders (No. 3379).

Aleutian Islands.—At Unalaska, J. M. Macoun, 1891. Part of Chamisso's type material was also collected here. Doubtless all the Unalaskan specimens were collected at a considerable elevation above sea level. On Atka Island, L. M. Turner, 1880, where it is a common plant among the patches of crowberry (*Empetrum nigrum*).

St. Matthew Island.—On well drained slopes of rock-weathered soil close to the level of the sea, Coville and Kearney (No. 2154), Trelease and Saunders (Nos. 3383, 3384), Brewer and Coe (No. 476). In similar situations on Hall Island, Coville and Kearney (No. 2083), Trelease and Saunders (Nos. 3081, 3082), Brewer and Coe (No. 438).

Point Barrow.—Near sea level, John Murdoch, 1882–3 (No. 24).

Siberian Coast.—Collected at Kayne, or Arakamtchechene, Island by the Ringgold and Rodgers U. S. North Pacific Exploring Expedition, C. Wright, 1853–6.

On the Asiatic side of Bering Sea the plant has been found at St. Lawrence Bay as already noted, and was collected on the Russian island of Karaginski by Mertens, the botanist of Lutke's voyage, in the years 1826–9. Ledebour in his Flora Rossica reports several localities in the inland parts of eastern Siberia. It is probable also that some of the specimens heretofore reported from Bering Sea and the adjacent coast of the Arctic Ocean under the name *Salix polaris* Wahl. belong

to this species. The type locality of Trautvetter's *rotundifolia* is given as St. Lawrence Island.

The nearest Alaskan relative of *Salix leiocarpa*, as indicated in the key, is *Salix phlebophylla* to which the student is referred for further comments on the peculiarities of this little group of species. *Salix polaris* also is a near relative. *Salix behringica* Seemen, recently described[1] from a specimen collected at "Luetke-Hafen,"[2] near Bering Strait, agrees in most respects with this species. Its leaves, however, are larger, 10 by 14 mm., and it is described as having an erect bushy growth. The specimen on which the description was based was a pistillate twig 17 cm. in length.

23. SALIX RETICULATA L. Netleaf Willow.

Plate XLII.

Salix reticulata L. Sp. Pl. 2: 1018. 1753.
Salix orbicularis ANDERS. in DC. Prod. 16^2: 300. 1868.

A prostrate willow very distinct in its characters, as given in the key, from any other Alaskan willow. Its filaments, in the staminate catkins, have their basal portion densely pubescent; in all other Alaskan willows the filaments are glabrous throughout. The scales of the pistillate catkins are broadly deltoid-obovate, dark, or sometimes pale, red-purple in color, smooth on the outside, or slightly hairy at the base, pubescent with short curled hairs on the inside, these hairs projecting only slightly beyond the end of the scale. In most willows the hairs on the catkin scales are long, straight and silky, commonly equaling the scale in length. Usually the leaves at maturity are entirely devoid of hairs, but sometimes, notably in the specimens from the St. Matthew Islands, the long, straight silky hairs frequently present on young leaves persist on both surfaces till the leaves are full grown, usually disappearing in age. The species is widely distributed in North America in arctic and arctic-alpine situations and occurs also in Asia and Europe. In Alaska it stretches over the Arctic zone, except in the extreme north, and southward it occurs at timber line on the mountains from the Juneau region to Kadiak Island, and westward to the Aleutian Islands.

Alaskan specimens have been examined as follows:

Juneau.—Near the summit of the mountains east of Juneau, at an elevation of 3000 feet, F. A. Walpole, 1900 (No. 1233).

[1] Seemen, Engl. Bot. Jahrb. Beibl. 52: 6. 1895.

[2] Lutke Harbor, I am informed by the Rev. Sheldon Jackson, general agent of education in Alaska, is the anchoring place for vessels behind the sandspit in St. Lawrence Bay, Siberia.

White Pass.—At an altitude of about 3,000 feet, F. A. Walpole, 1900 (No. 1110). At Lake Bennett, J. B. Tarleton, 1899 (No. 15).

Yukon River.—At Coal Creek Hill, Frederick Funston, 1893 (No. 143).

Glacier Bay.—At various points near sea level, Coville and Kearney (No. 669), Trelease and Saunders (Nos. 3395, 3435, in part, 3436, 3438, 3440), Brewer and Coe (No. 49).

Yakutat Bay.—Near Hidden Glacier, Trelease and Saunders (No. 3441, in part).

Prince William Sound.—At timber line at Orca, elevation about 2500 feet, Coville and Kearney (No. 1192).

Cook Inlet.—Between Cook Inlet and the Tanana River, E. F. Glenn, 1899.

Kadiak Island.—On the mountain back of Kadiak village, Trelease and Saunders (No. 3396), Coville and Kearney (No. 2312), Cole, F. A. Walpole, 1900 (No. 1181). Mountains back of English Bay, Coville and Kearney (No. 1455). At Sturgeon River, Coville and Kearney (No. 2280). Without special locality, C. H. Townsend, 1888.

Alaska Peninsula.—At Kukak Bay, Coville and Kearney (Nos. 1490, 1537), Trelease and Saunders (No. 3390), Kincaid.

Shumagin Islands.—On Popof Island, Kincaid. Also specimens of M. W. Harrington, 1871–2, probably collected on these islands.

Aleutian Islands.—Unalaska, Coville and Kearney (No. 2199), Trelease and Saunders (No. 3397), B. W. Evermann, 1892 (No. 156), Attu Island, J. M. Macoun, 1891.

Pribilof Islands.—On St. Paul Island, William Palmer, 1890 (No. 310, in part), C. Hart Merriam, 1891, Kincaid, 1897.

St. Matthew Islands.—On St. Matthew, Coville and Kearney (Nos. 2089, 2147, 2177), Trelease and Saunders (No. 3393), Brewer and Coe (No. 465). On Hall Island, Coville and Kearney (No. 2081), Trelease and Saunders (Nos. 3391, 3392).

Cape Vancouver.—Collected by J. M. Macoun, 1891.

Port Clarence.—On the tundra, Coville and Kearney (No. 1872), Trelease and Saunders (No. 3398), Brewer and Coe (Nos. 377a, 396). At the Reindeer Station, James T. White, 1894.

Reported at various points on the Arctic seacoast of Alaska but not beyond Cape Lisburne.

Andersson in 1868, as cited in the synonymy, gave to the east Siberian and Alaskan representative of the circumpolar arctic and arctic-alpine *Salix reticulata* the distinguishing name *Salix orbicu-*

laris, and Dr. Rydberg in taking up this name[1] extends the range of the species across the continent, and states that he has seen no typical specimens of *Salix reticulata* from North America. The distinguishing characters assigned by Andersson are the yellowish rose-colored catkin scales and elliptic-rotund, oval-rotund, elliptic-obovate, or oblong leaves of *reticulata* and the fuscous scales and suborbicular, or obovate-orbicular leaves of *orbicularis*. He says also of the latter species, "Truncus longissime serpit ramulos subvillosos radiciformes undique emittens," and, "A formis vulgaribus S. reticulatae habitu abunde diversa." Of these leaf characters it may be said that we have specimens with oblong leaves from Alaska, and specimens with orbicular leaves from northern Europe, and Dr. Rydberg, although maintaining the species to be distinct, says, "The two cannot be distinguished by the leaves." Our Alaska collection contains specimens with pale rose-colored scales, and we have European specimens with dark purple scales. As for habit character, we have specimens from Alaska, collected in drier situations than usual, with branches just as short and rootless and congested as any of those from Europe. An equal lack of constancy is found in the distinguishing characters assigned by Dr. Rydberg. Our specimens of European *reticulata* have bracts not "oblong" but broadly obovate, and instead of being "densely woolly" they are rarely hairy over the entire surface and are often smooth throughout. The size of the capsule and the density of its hairy covering appear to be correlated not with the continental origin of specimens but with the degree of maturity of the capsule itself. While European as well as American specimens show much variation among themselves, I am unable, from the material now available, to see in our American plant a species distinct from the European.

Andersson in 1868 published a *Salix venusta*[2] from Sitka, the description of which suggests that the plant may prove to be a form of *Salix reticulata* grown in a shaded situation. It is described as differing from *reticulata* in its long styles and its leaves bright green on both sides though somewhat paler beneath. It is very desirable that the plant be again collected. It should be looked for on Mount Verstovia.

[1] Rydberg, Bull. N. Y. Bot. Gard. 1: 260. 1899.

[2] Anders. in DC. Prod. 16²: 288. 1868, not Host. 1828.

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PLATE XXXIII.

Salix sitchensis Sanson.

FIG. *a*. Staminate flowering branch, natural size.

b. Staminate flower, showing the nectary, scale, and the single stamen, enlarged six diameters.

c. Pistillate flowering branch, natural size.

d. Pistillate flower viewed from above, enlarged six diameters.

e. Same, lateral view.

f. Fruiting branch, with mature foliage.

g. Capsule, viewed from the side, showing dried scale and nectary, enlarged two diameters.

h. Capsule, split open in dehiscence, enlarged two diameters.

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SALIX SITCHENSIS

PLATE XXXIV.

Salix alaxensis (Anders.) Coville.

FIG. *a*. Staminate flowering twig, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering twig, natural size.

d. Pistillate flower, viewed from above, enlarged six diameters.

e. Branch with nearly mature catkins, natural size.

f. Capsule, two views, enlarged two diameters.

g. Leafy branch, natural size.

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SALIX ALAXENSIS

PLATE XXXV.

Salix amplifolia Coville.

FIG. *a*. Pistillate flowering twig, seven-eighths natural size.

b. Pistillate flower, enlarged five diameters.

c. Staminate flowering twig, seven-eighths natural size.

d. Staminate flower, enlarged five diameters.

e. Branch with fruit and nearly mature leaves, seven-eighths natural size.

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SALIX AMPLIFOLIA

PLATE XXXVI.

Salix barclayi Anders.

FIG. *a*. Staminate flowering twig, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering twig, natural size.

d. Pistillate flower, viewed from above, enlarged six diameters

e. Same, lateral view.

f. Fruiting branch, natural size.

g. Capsule, two views, enlarged two diameters.

h. Outlines of leaf margins, enlarged three diameters.

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SALIX BARCLAYI

PLATE XXXVII.

Salix commutata Bebb

FIG. *a*. Staminate flowering twig, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering branch, natural size.

d. Pistillate flower, enlarged six diameters.

e. Fruiting branch, natural size.

f. Capsule, two views, enlarged two diameters.

g. Outline of typical medium-sized leaf, natural size.

h. Outline of leaf margin, enlarged three diameters.

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SALIX COMMUTATA

PLATE XXXVIII.

Salix pulchra Cham.

FIG. *a*. Staminate flowering twig, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering twig, natural size.

d. Pistillate flower, viewed from above, enlarged six diameters.

e. Same, lateral view.

f. Another pistillate flower, viewed from above, same enlargement.

g. Twig with mature fruit, natural size.

h. Portion of twig and fruiting catkin, showing a peduncle, natural size

i. Capsule, two views, enlarged two diameters.

j. Leafy branch, natural size.

k. Typical leaf, showing stipules, natural size.

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SALIX PULCHRA

PLATE XXXIX.

Salix glauca L.

FIG. *a*. Staminate flowering twig, natural size.

b. Staminate flower, enlarged six diameters.

c. Another staminate flower, same enlargement.

d. Pistillate flowering twig, natural size.

e. Pistillate flower, enlarged six diameters.

f. Another pistillate flower, same enlargement.

g. Branch with leaves and mature fruit, natural size.

h. Capsule, two views, enlarged two diameters.

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SALIX GLAUCA

PLATE XL.

Salix arctica Pall.

FIG. *a*. Staminate flowering branch, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering twig, natural size.

d. Pistillate flower, enlarged six diameters.

e. Branch with leaves and mature fruit, natural size.

f. Capsule, two views, enlarged two diameters.

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SALIX ARCTICA

PLATE XLI.

FIGURE 1.

Salix stolonifera Coville.

a. Staminate flowering branch, natural size.
b. Staminate flower, enlarged six diameters.
c. Pistillate flowering twig, natural size.
d. Pistillate flower, enlarged six diameters.
e. Fruiting branch, natural size.
f. Capsule, two views, enlarged two diameters.
g. Portion of underground stem, with stolon, natural size.

FIGURE 2.

Salix leiocarpa (Cham.) Coville.

a. Staminate flowering branch, natural size.
b. Staminate flower, enlarged six diameters.
c. Pistillate flowering twig, natural size.
d. Pistillate flower, enlarged six diameters.
e. Fruiting branch, natural size.
f. Capsule, two views, enlarged two diameters.

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SALIX STOLONIFERA
SALIX LEIOCARPA

PLATE XLII.

Salix reticulata L.

FIG. *a*. Staminate flowering branch, natural size.

b. Staminate flower, enlarged six diameters.

c. Pistillate flowering twig, natural size.

d. Pistillate flower, viewed from above, enlarged six diameters.

e. Same, lateral view.

f. Fruiting branch, natural size.

g. Capsule, two views, enlarged two diameters.

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SALIX RETICULATA

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